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OF THE

INDIAN COFFEE BOARD

(1952-53)

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38	29	vigorosly	vigorously
41	34	g	gram
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57	23	52·50	62·50
75	45	spreades	spreaders
82	25	yeaas	years
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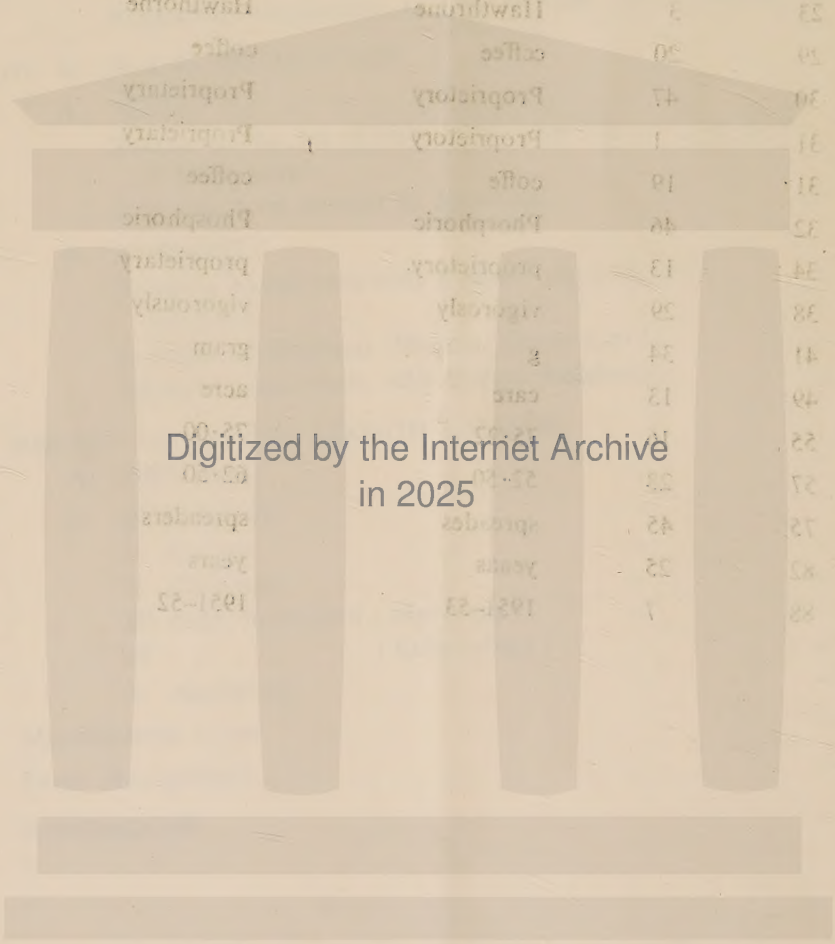

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INDIAN COFFEE BOARD

(Research Department)

The Sixth Annual Report of the Research Department of the Indian Coffee Board (1952-1953).

INTRODUCTORY

1. **Administration:** Mr. K. M. Thomas was in charge of the Research Department till 19th May, 1953, when he retired from the service of the Board and I took over charge of the office of the Director of Research from the forenoon of 20th May, 1953, and continued to be in charge of the Department till the end of the year. I was on deputation to the Tea Research Station, Tocklai, Jorhat, Assam, for a period of fifteen days from 5th June to 20th June, 1953, during which period Dr. N. G. Chokkanna, Chief Chemist, was in charge of my duties at the station. Dr. N. G. Chokkanna, Mr. R. L. Narasimhaswamy and Mr. Pattabhiraman continued to be the Chief Chemist, the Assistant Botanist and the Liaison Officer throughout the year. The latter was promoted as Senior Liaison Officer in the new liaison section set up at the beginning of January, 1953.

Sri S. Sundaram, who was on foreign service, continued to be the Agronomist till the 30th November, 1952, and was then reverted to the Agricultural Department, Madras, on completion of the period of loan of his services in the Board. Sri S. V. Kuppuswamy, who was on foreign service, continued to be the Assistant Chemist till the 24th September, 1952, and was then reverted to the Agricultural Department, Madras, on the expiry of the period of loan of his services in the Board. Sri K. B. Ponnappa, Retired District Treasury Officer, Mercara, Coorg, who was appointed as Secretary to the Director of Research for a period of one year, joined duty on the forenoon of 8-3-1953 and continued to be as such during the rest of the year under report. Sri P. K. Mathew was appointed as Assistant Chemist in place of Sri S. V. Kuppuswamy (reverted) who reported for duty on the 21st March, 1953, and continued to be as such during the period under report. Sri H. T. Ranga Setty, appointed as Graduate Assistant in Entomology, reported for duty on 1st July, 1952. Sri H. Hanumantha Rao, appointed as Graduate Assistant in Agronomy, reported for duty on 21-8-1952. Sri C. I. George, who was appointed as Fieldman, reported for duty on 23-7-1952. Sri M. K. Srinivasan was appointed as Stenographer who reported for duty on the 3rd January 1953. All of them continued to be as such till the end of the year under report. Sri O. K. S. Panickker, Senior-most clerk, was promoted as Farm Accountant with effect from 24-6-1953.

2. **Extension Service:** A further step in the setting up of the liaison service was taken with the appointment of the undermentioned eight probationers for the liaison section of the Department started early in 1951—

Messrs. K. V. George
G. H. Shankara Reddy
S. J. Mathias
K. T. Bhagath
H. S. Puttuswamy
B. K. Chandrappa
G. I. D'Souza
W. Raghavendra Rao

These probationers were under training at the Coffee Research Station, Balehonnur, in the various technological sections. They are due to be posted to different coffee estates in selected coffee zones for intensive practical training. It is hoped that with the posting of these officers to zonal areas, the objective of approaching the smaller planter and catering to his needs and attending to his problems with which this service was set up, will become nearer realization.

3. **Season and Crop:** (*a*) Balehonnur: The total rainfall during the year was 92·48 inches as against the decennial average of 106·40 inches of annual precipitation. The South-West monsoon which commenced in the latter part of June, did not strengthen and continued to be a weak one. A few heavy bouts of rain with a high precipitation of 7·46 inches on one day in the last week of July accounted for much of this total rainfall. During July to September there occurred a deficit of 12·48 inches of rain due to abnormally indifferent and low rainfall in the months of July and September, made good to some extent by heavy rains in August 1952. The monsoon weakened off in September. October had a more than average precipitation with 13·07 inches against the decennial figure of 6·11. November was completely dry; 1·42 inches in December resulted in an incipient opening of blossom, and 0·02 inch fell in January. February and March were again dry. A few showers in April with a total of 2·40 inches was followed by an unusually dry May with 0·49 inches four weeks after the blossom showers. The South West monsoon of 1953 seemed to have commenced with confidence and with gathering strength. June recorded a rain-fall of 15·36 inches, an increase of 2·11 inches over the decennial average for the month.

The crop picked during the year 1952–53 fell far short of the estimates; only 4½ tons of arabica were picked against 10·5 tons estimated. However 4·25 tons of robusta were picked against the original estimate of three tons. A major portion of the arabica blossom which opened in February 1952 did not swell and seemed to have shanked off

during the monsoon, a set back reported in many parts of Mysore, Niligiris and Shevaroys.

The first rain in April after the long drought occurred on 7th April and it continued to rain at intervals till 18th, blossom opening on 18th, 19th and 20th. The follow up showers were practically nil and some of the spikes got burnt off. Nevertheless, it is expected that a total of 16·5 tons of crop will be picked, provided seasonal conditions continue to be promising. 12·25 tons of arabica and 4·25 tons of robusta are expected to be picked.

Leaf disease was fairly widespread during the year but black-rot was not severe, probably due to deficit precipitation. Spraying of Bordeaux mixture was done in September as well as in May for checking the spread and timely control. The ensuing year may not suffer from such bad leaf disease as long drought conditions prevailed during the summer. This was to a certain extent aided by the timely spraying programme of 1953 summer. Stem borer infestation was about 4·13% during the year. Uprooting and burning of the bored plants were done in September–December and in April–June. In four rounds of going over the estate, 5701 plants were uprooted and 873 plants were stumped. Application of B.H.C. 50% water dispersible powder at the rate of the usual 8 lb. in 40 gallons of water to the main stem and thick primaries was done in badly infested areas. The programme for the ensuing year has got complete estate coverage with B.H.C. Green bug was not serious in the Station, excepting for a few patches in the 17 acres and Ichalgudda new clearings. Spraying with H.E.T.P. was undertaken to control the pest. Shot-hole borer was fairly evident in robusta. Thinning of the shade and pruning and burning of the affected twigs were done to control the pest.

(b) *Chethalli:* The total rainfall at Chethalli amounted to 50·59 inches against an average of 73·22 inches over a thirteen year period and 62·30 inches in the previous year. The South-West monsoon was moderately active from July to September and was followed by a weak North-East in October and November. The period from end of November to the end of March was entirely rainless with 18 cents recorded on 31st of the latter month. The following period was again dry till 16th April 1953 when the blossom showers were first received followed by another shower on 20–4–1953, totalling in all 2·06 inches which enabled the blossom to open uniformly.

The crop for 1952–53 was estimated at the low figure of 8 tons, in the light of the very indifferent blossom showers received in April 1952 and the long drought preceding it and the inadequate and vagarious rainfall following it. Actually the picked crop proved to be very much bigger than estimates. A total of 14·3 tons of coffee composed of 13·4 tons of arabica and 0·9 ton of robusta were picked.

The blossom showers for the 1953–54 Crop was received on 15th April 1953 with a rainfall of 1·12 inches followed up by another 0·32 inch and 0·25 inch on the succeeding days. The amount of rain was quite adequate for a uniform blossom and, on the blossom, the 1953–54 crop has been estimated at 18 tons, which is the maximum ever since the origin of this Station.

Leaf disease was fairly severe and wide-spread during the year. Post-monsoon spraying was done at the proper time in September but owing to the severe drought conditions, pre-monsoon spraying early in 1953 had to be deferred till adequate supplies of water had been obtained. Nevertheless, it is noticed that the regular practice of double spraying has checked the disease considerably.

The number of removals of bored plants was of the low order of 694. Swabbing with agrocide was under-taken over the whole estate, once early in November 1952 and again in April-May 1953. It would appear as though these two operations have checked borer infestation and spread to a considerable extent.

(The meteorological data recorded in the two Stations are given in apendices I, I–A and II.)

4. General:

(a) *Construction of Buildings*: Construction of three Senior Officer's quarters was taken up during the year under report and one of them was nearing completion. Preliminary arrangements were made for the construction of a field laboratory at Chethalli. In order to ease pressure on water requirements for estate and domestic purposes, two wells were constructed, one each at Chethalli and at Balehonnur.

(b) *Committee Meetings*: Four meetings of the *ad hoc* Committee at Balehonnur and three meetings at Chethalli were conducted during the year. Two meetings of the Research Committee and four meetings of the Board were attended.

(c) *Exhibitions*: The Research Department participated in the U.P.A.S.I. Exhibition and Conference at Coonoor in August, 1952. A Field Day was held at the Coffee Research Sub-Station, Chethalli, in November, 1952. This was inaugurated by the Chief Commissioner of Coorg who was supported by the Home Minister, Coorg. It was largely attended by leading members of the official, non-official and the planting sectors.

(d) *Staff Meetings*: Five staff meetings were held at Balehonnur for discussing the programme of research work, administrative matters, social amenities and budget position of the station. Two informal staff meetings were also held at Chethalli.

(e) *Library*: Thirtynine journals were subscribed for, and 19 journals were received on exchange basis. 74 new books were added on to the library bringing the total to 848 at the end of the year. 86 volumes of loose numbers were got bound. The total expenditure on library was about Rs. 2,870.

(f) *Correspondence*: The number of correspondence dealt with during the year was as follows:—

Inward - 7003
Outward - 8354

(g) *Audit of accounts*: The audit of accounts for the year 1951–52 of Balehonnur was conducted by the Accountant General in Mysore, Bangalore, during November, 1952, and that of Chethalli in February 1953. The Accounts Officer of the Board check inspected Balehonnur once and Chethalli twice during the year under report.

(h) *Visits*: The Central Station at Balehonnur was honoured by a visit from Sri K. Hanumanthayya, Chief Minister, Mysore State, in June 1953, and from Sri H. Siddaveerappa, Home Minister, Mysore State, and Chairman, Research Committee of the Indian Coffee Board, in April 1953.

Dr. William H. Cowgill, Regional Consultant in Horticulture, Instituto Agropecuario Nacional, "La Aurora", Guatemala, C. A., and Dr. Frederick L. Wellman, Consultant in Plant Pathology, Inter American Institute of Agricultural Sciences, Turrialba, Costa Rica, visited the Coffee Research Station, Balehonnur, in October 1952 under the U. S. Point IV Programme of technical aids to under-developed countries. They stayed for three days on the Station and held discussions with the technical officers and the Director of Research. Notes on their visit have been published separately.

The main station had the privilege of receiving over 50 interested planters during the year. More than a hundred were received at the Coffee Research Sub-Station, Chethalli, apart from those who attended the Field Day.

(i) *Exchange of Seed material*: The station is particularly indebted to the following persons and institutions for sending us valuable coffee and other seed and seedling material.

Seed Coffee :

1. Dr. W. H. Cowgill, Instituto Agropecuario Nacional, La Aurora, Guatemala, Central America.
2. Agronomist, Federal Experiment Station, Serdang, Malaya.
3. Senior Research Officer, Coffee Research and Experimental Station, Lyamungu, Moshi, Tanganyika Territory.
4. Dr. Pierre G. Sylvain, Coffee Specialist, F.A.O., Addis Ababa, Ethiopia.

Coffee seedlings:

5. Dr. W. H. Hodge, Economic Botanist, Specialty Crop Introductions, U.S. Department of Agriculture.

Shade Tree Seeds:

1. Dr. W. H. Cowgill, Instituto Agropecuario Nacional, Guatemala, Central America.
2. Director, Tea Research Institute of Ceylon, St. Coombs, Ceylon.

(j) *Publications*: The following papers were published in Indian Coffee.

1. "Weed Control in Coffee Plantations" by K. M. Thomas and R. L. Narasimhaswamy.
2. "Green Manures and Coffee" by L. V. Vaidyanathan, S. V. Kuppuswamy and N. G. Chokkanna.
3. "Estimation of Phosphorus in Soils" by N. G. Chokkanna, L. V. Vaidyanathan and S. V. Kuppuswamy (Published in '*Current Science*')
4. 'Two Liaison Reports' by T. V. Pattabhiraman.
5. Notes on the Visit of Drs. W. H. Cowgill and F. L. Wellman.

(k) *Acknowledgements:* It is my privilege and pleasant duty on behalf of the staff of the Research and Liaison Section to record our deep debt of gratitude to Mr. K. M. Thomas, till lately the Director of Research, for his able guidance, uniform kindness and courtesy to all concerned. By his retirement the Department has lost a friend, philosopher and guide. It is, however, hoped that his interest in coffee industry will continue to evince itself in close association with this department and his mature advice will still be available to the Department. To the various grades of executive and ministerial officers at the two Research Stations, I express my thanks for their co-operation and unstinted hard work. It is with pleasure that my colleagues and I record the kindness and consideration which we have received from the members of the Board. To many scientists in India and abroad who exchanged their publications and to those firms who have given generous samples of their insecticidal and fungicidal products, I have to record my thanks. To the planting community who have placed at the disposal of the department their knowledge and problems and above all for their traditional generosity and hospitality to my predecessor in office, myself and my staff alike I express my grateful thanks.

B. T. NARAYANAN,
Director of Research.

RESEARCH

I. BOTANY

A. **Coffee Breeding:** Work on coffee breeding was continued as in the previous years: (1) Production of cross-bred seeds for exploring the behaviour of the progeny regarding high yield and resistance to leaf disease, (2) vegetative propagation of clonal material from good bearers, (3) comparative trials of clonal plants from the good bearers and (4) collection of plant material for establishing at the Station, formed the principal work of the section. Coffee seedlings and seed material were obtained by courtesy of the U. S. Department of Agriculture, Instituto Agropecuario Nacional, Guatemala, Coffee Research and Experiment Station, Lyamungu, Federal Experiment Station, Malaya, and from the Coffee Specialist of the F.A.O. in Ethiopia as stock material for our future work on breeding.

2. **Arabica:** The breeding of arabica coffee with a view to find out the best combinations of parents was continued as also selfing of selected plants for raising further progeny. The details of work done are furnished in Table B–I.

3. **Field studies of advanced generation of hybrids:** The following selections were planted in strips in a plot laid out on hedge row system of planting. The distance between the rows is 9 feet and between plants in the row is 4 feet. The rows run along the contour of a slope of 30° incline. Between rows of coffee *Crotalaria anagyroides* has been sown. Dadap stakes have been planted for providing shade.

Seedlings produced from	No. of seedlings planted	Seedlings produced from	No. of seedlings planted
S. 795, 1/8	79	S. 583, 1/9 x S. 26	9
S. 795, 1/12	80	S. 580, 2/13 x 645, 1/6	39
S. 795, 2/6	81	S. 583, 6/11 x 327, 3/10	8
S. 795, 2/10	80	S. 583, 6/11 x 583, 1/9	5
S. 795, 3/9	82		
S. 795, 3/7	78		
S. 333–7	99		
S. 327, 2/10	80		
S. 583, 1/9 x 333–8	77	Total ..	797

During the hot weather the plants were watered by hand. So far there has been no signs of development of leaf disease in any of these plants.

4. A fresh batch of seedlings as detailed in the accompanying table was raised in the nursery to provide planting material for test purposes during the next season.

Seeds produced from	No. of seedlings raised	Seeds produced from	No. of seedlings raised
327, 3/10 x 583, 1/9	20	580, 2/13 x 327, 3/10	40
327, 3/10 x 644, 1/13	110	580, 2/13 x S. 26	55
S. 31 x S. 22	435	B.A. 1	80
645, 1/6 x 583, 1/9	130	B.A. 9	183
583, 1/9 x 327, 3/10	280	B.A. 12	160
583, 6/11 x 327, 3/10	42	B.A. 13	160
580, 2/13 x 645, 1/6	75	B.A. 29	140
583, 6/11 x 583, 1/9	8		
		Total ..	1918

5. **Comparative trials of clonal plants from best performers:** (*i*) Clonal progeny of 20 arabica cultures of the B. A. series were planted in a randomised replicated experiment. As the number of clonal plants in each culture was limited, the replications were limited to three during the planting season in August 1951 and increased to 8 during July 1952. The lay-out is given below:—

Locality: Balehonnur (Mysore).
Variety: Arabica (hybrids).
Treatment: 20 cultures of B.A. series.
Replications: 8.
Area of the experimental block: 59·5 cents.
Lay-out: Randomised block.
Plot: 3 plants in a row.
Guard rows: One on either side.
Spacing: 6 ft. × 6 ft.
Shade: Natural shade.

Treatments: 20 cultures of the B. A. series are:—

B. A. 5	B. A. 19	B. A. 24	B. A. 31.
B. A. 6	B. A. 20	B. A. 25	B. A. 32.
B. A. 11	B. A. 21	B. A. 26	B. A. 34.
B. A. 12	B. A. 22	B. A. 27	B. A. 35.
B. A. 13	B. A. 23	B. A. 30	B. A. 36.

(*ii*) Clonal progeny of 15 arabica cultures of the B. A. series and seedling progeny of B. A. 19 were planted in a randomised replicated experiment. As the number of clonal plants in each culture was limited, the replications were limited to three during the planting season in July 1952 and increased to 8 during July 1953. The lay-out is given below:—

Locality: Balehonnur (Mysore).
Variety: Arabica (Hybrids).
Treatment: 16 cultures of B.A. series.
Replications: 8.
Lay-out: Randomised block.
Plot: 3 plants in a row.
Guard rows: One on either side.
Spacing: 6 ft. × 6 ft.
Shade: Natural shade.

Area of experimental block: 45 cents.

Treatments: 16 cultures of B.A. series are:—

B. A. 1	B. A. 9	B. A. 15	B. A. 28.
B. A. 4	B. A. 10	B. A. 16	B. A. 29.
B. A. 7	B. A. 13	B. A. 17	B. A. 33.
B. A. 8	B. A. 14	B. A. 18	B. A. 19 (seedlings).

On account of the very dry conditions prevailing in the hot weather months, the clones planted during July 1952 were hand-watered twice a week from February till June. There was no mortality of the plants and there has been no development of leaf disease.

During 1949–50, individual yield records maintained for station selections through many years were studied as well as the resistance to leaf disease shown by them under field conditions. After the study, 36 best yielding plants were marked from among the self-bred progeny of the original station selections bearing identifying numbers S.26, S.31, S.44, S.47, S.58, S.61, S.73, S.178 and S.179 and the cross bred progeny of S.26 × Kent and S.31 × S.22. These 36 plants were marked B.A. 1, B.A. 2,....B.A. 36 (B.A. stands for "Balehonnur Arabica") to differentiate them from the identifying numbers given to the original station selections. The following table shows the origin of the 36 plants of the B.A. series from among the original station selections.

Mother Plant	Progeny from which selection was made		Number given in the B.A. Series
S.26			B.A. 35
S.26	1st generation :	S. 288	B.A. 1, B.A. 2, B.A. 3
		S. 329	B.A. 4, B.A. 5, B.A. 6
		S. 526	B.A. 33
	F 1 of S.26 x Kent :	S. 327	B.A. 8, B.A. 9, B.A. 10, B.A. 11, B.A. 12
S.31			B.A. 36
	2nd generation :	S. 644	B.A. 20
	F 1 of S.31 x S. 22 :	S. 333	B.A. 13, B.A. 14, B.A. 15, B.A. 16, B.A. 17, B.A. 18
	F 2 of S.31 x S. 22 :	S. 645	B.A. 19
S.44	1st generation :	S. 333	B.A. 26, B.A. 27, B.A. 28
	2nd generation :	S. 576	B.A. 29
S.47	2nd generation :	S. 580	B.A. 30
S.58	1st generation :	S. 370	B.A. 7
S.61	1st generation :	S. 373	B.A. 32
S.73	1st generation :	S. 434	B.A. 34
S.178	1st generation :	S. 583	B.A. 21, B.A. 22, B.A. 23, B.A. 24, B.A. 25
S.179	1st generation :	S. 585	B.A. 31

6. **Grading of arabica selections according to size and shape:** Bean measurements of arabica selections of the B.A. series were done and the details of the measurements are given in Table B–II.

Table B–III summarises the classification of the selections according to bean shape and size.

7. **Selections from private estates:** Recording of yield and analysis of the crop from the preliminary selections marked in Gundicad block of Netraconda Estate were continued and the data are given in Table B–IV. On account of low yield, high triage or both, selections Net. E and Net. F have been discarded. Clonal progeny of selections Net. A, Net. B, Net. C and Net. D have been raised at the Station.

8. Seedlings raised from seeds collected in the previous years from marked plants in private estates were planted in contiguous plots for observation at the Station. Details of seedlings planted are given below:—

Estate	Selection	No. of seedlings planted	Remarks
Kurkenmutty	Arabica Hyb. 1	53	Seedlings have not developed leaf disease.
,,	Arabica Hyb. 2	37	
,,	Arabica Hyb. 3	63	
,,	Arabica Hyb. 4	84	
Lalbagh	Arabica Hyb. 1	43	
,,	Arabica Hyb. 2	42	
Hirecola	Arabica Hyb.	20	
Moganaad Peak	Arabica Hyb.	25	

On account of the very dry conditions prevailing in the hot weather months, it was found necessary to hand-water the plants twice a week from February till June.

9. Ninety plants were raised from sucker cuttings and 556 seedlings were raised from seeds obtained from marked plants in private estates. Details of plants thus raised are given below:—

Estate	Selection	No. of plants raised		Remarks
		Clones	Seedlings	
Kurkenmutty	Arabica Hyb. 1	9		The plants in the nursery have shown vigorous growth and have not developed leaf disease.
,,	Arabica Hyb. 2	4		
,,	Arabica Hyb. 3	12		
,,	Arabica Hyb. 4	7		
Kelaganne	Arabica Hyb. B	8		
,,	Arabica Hyb. C	7		
,,	Arabica Hyb. D	4		
,,	Arabica Hyb. E	11		
Shigode	Arabica Hyb.	28		
Badnekhan	Arabica Hyb.	—	9	
Flora	Arabica Hyb. 1	—	220	
,,	Arabica Hyb. 2	—	189	
Karadibetta	Arabica Hyb.	—	100	
Hittgecool	'Basith' Hyb.	—	38	

10. **Collection of seed material from foreign countries:** (*i*) The year was highlighted by the collection of seed coffee from foreign countries. The details of seeds obtained and seedlings raised from the seeds are given below:—

Species		No. of seedlings raised	Seed material received from
Coffea arabica varieties:	Typica	160	Dr. W. H. Cowgill Instituto Agropecuario Nacional, La Aurora, Guatemala, Central America.
	Bourbon	84	
	Pache	44	
	Le-Roy (Laurina)	215	
	Sumatra	144	
	Surinam	160	

Continued

Species		No. of seedlings raised	Seed material received from
Coffea arabica varieties :	San Ramon	258	Dr. W. H. Cowgill Instituto Agropecuario Nacional, La Aurora, Guatemala, Central America.
	Bluemountain	112	
	Padang	196	
	Philippinean	207	
	Guadaloupe	140	
	Pretoria	101	
	Columnaris	250	
	Kona	279	
	Murta	58	
	Mokka	56	
Coffea Stenophylla		87	
Coffea Canephora		15	
Coffea Dewevrei		13	
Coffea Dewevrei Excelsa		40	
Kawisari		8	Agronomist, Federal Experiment Station, Serdang, Malaya.
Coffea arabica selections :	N. 39	172	Senior Research Officer, Coffee Research and Experimental Station, Lyamungu, Moshi, Tanganyika Territory.
	N. 197	160	
	N. 205	165	
	H. 66	206	
	KP. 152	155	
	KP. 423	195	
	KP. 532	197	
Coffea arabica :	S. 8 Tafarikela	165	Dr. Pierre G. Sylvain, Coffee Specialist, F. A. O., Addis Ababa, Ethiopia.
	S. 9 Arba Congon	24	
	S. 12 Kaffa	460	
	Total ..	4526	

(*ii*) One hundred and forty seedlings of 5 varieties of *Coffea arabica* were sent by air by Dr. W. H. Hodge, Economic Botanist, Speciality Crop Introductions, U. S. Department of Agriculture. The seedlings arrived in a very healthy condition and have developed well at the Station.

Coffea arabica varieties	No. of seedlings
Bourbon amarelo	30
Bourbon vermelho	20
Caturra amarelo	30
Laurina maragogype	30
Mundo novo	30
Total ..	140

11. **Robusta: Comparative trials of clonal plants from best performers :** (*i*) Clonal progeny of ten robusta cultures (B.R. series) were planted in a randomised replicated experiment. As the number of clonal plants in each culture was limited, the replications were limited to five

during the planting season of August 1951 and later they were increased to nine during July 1952. The lay-out is given below:—

Locality: Balehonnur (Mysore). *Layout:* Randomised block.

Variety: Robusta. *Plot:* 3 plants in a row.

Treatment: 10 cultures of B.R. series. *Guard rows:* One on either side.

Spacing: 9 ft. × 9 ft.

Replications: 9. *Shade:* Natural shade.

Area of Experimental block: 95 cents.

Treatments: 10 cultures of B.R. series are—

B.R. 2	B.R. 5	B.R. 7	B.R. 11	B.R. 15
B.R. 3	B.R. 6	B.R. 9	B.R. 12	B.R. 17.

The plants suffered very much on account of continued drought conditions. A heavy leaf drop occurred both in the coffee as well as in the dadap plants. Hand-watering was done twice a week from February till June. There was no mortality. However, growth took place only after commencement of the rains in June.

(*ii*) Clonal progeny of nine robusta cultures and seedling progeny of S.274 were planted in a randomised replicated experiment. As the number of plants in each culture was limited, the replications were limited to four during the planting season of July 1952 and later they were increased to eight during July 1953. The lay-out is given below:—

Locality: Balehonnur (Mysore). *Lay-out:* Randomised block.

Variety: Robusta. *Plot:* 3 plants in a row.

Treatments: 9 cultures of B.R. series. *Guard rows:* One on either side.

Spacing: 9 ft. × 9 ft.

Replications: 8. *Shade:* Natural shade.

Area of experimental block: 93 cents.

Treatments: Nine cultures of B.R. Series and seedling progeny of S. 274 are—

B.R. 1	B.R. 6	B.R. 10	B.R. 14	B.R. 17
B.R. 4	B.R. 8	B.R. 13	B.R. 16	Seedling progeny of S. 274.

On account of the drought conditions in the dry and the hot weather months, the plants were hand-watered once a week from February till June. There was no mortality of the plants.

12. **Grading of robusta selections according to size and shape:** Bean measurements of robusta selections (B.R. series) were done and the details of measurements are furnished in Table B–V.

13. Classification of selections of B.R. series according to size and shape are given in Table B–VI.

14. **Extension work with selections:** The demand for seed coffee from the leaf disease resistant selections of the Station has been on the increase. Though it has not been possible to meet all these demands in full, every effort was made to collect more seed material. Table B–VII shows the progressive increase in the quantities of seed coffee distributed from 1949 inclusive of seeds from station selections, Kents arabica, robusta and excelsa. 75 percent seedlings raised from seeds of arabica selections show resistance to races I and II of leaf disease, Hemileia vastatrix, B. and Br., that affect Coorg and Kent varieties respectively. Upto 25 percent show susceptibility to the two races. Though this segregation is observed from critical studies done at the station, it is noticed that in plots of selections raised in a number of estates the leaf disease susceptible plants occur upto 15 percent.

The selections may get attacks of 'Black–rot' and 'Cercospora eye-spot'. To control these diseases spraying with Bordeaux mixture at 2:2:40 strength is advocated.

15. Seeds from coffee selections were supplied to foreign countries. Details are given below—

Selections from which seeds were supplied	To whom supplied
B.A. 2; B.A. 3; B.A. 8, B.A. 10; B.A. 13; B.A. 14; B.A. 16; B.A. 21; B.A. 27; B.A. 35; B.A. 36; 964,2/1.	Dr. W. H. Hodge, Economic Botanist, Specialty Crop Introductions, U.S. Department of Agriculture, Beltsville, Maryland.
286–7; 353,4/5; 288–23; D.K.–1/6.	Dr. Branquinho, D'Oliveira, Head of Pathology Department, Estacao Agronomico Nacional, Sacavem, Portugal.
B.A. 22; B.A. 29.	Sr. Research Officer, Coffee Research and Experimental Station, Lyamungu, Moshi, Tanganyika Territory.

16. **Regional Nurseries:** Eight old regional nurseries were functioning against eleven in the previous year. Two new nurseries (1) in Waverly estate (Anamallais) and (2) in Singampatti Group Estate (Tirunelveli district) were opened during the period under report so that ten nurseries were operating. A sum of Rs. 1,490–15–0 was realised by the sale of seedlings raised in the regional nurseries and a sum of Rs. 1,583–4–4 was paid to the estates towards the cost of raising and maintaining the nurseries. Details of seeds supplied, seedlings raised at the end of the year and seedlings distributed during the year from the regional nurseries are furnished in Table B–VIII. Seeds were supplied free to all the regional nurseries. 20 per cent of the seedlings raised were supplied free to the estate raising the regional nursery. The remaining 80 per cent of the seedlings were sold @ Re. 0–1–0 per seedling to applicants.

17. **B. Vegetative Propagation:** Emphasis was laid on the raising of clonal progeny of 36 arabica and 17 robusta single plant selections, as well as S. 26 and S. 31. A total of 1392 plants were produced from these. Besides, 1201 clonal progeny from selected Kent plants, 86 clonal progeny from S. 795 and 134 clonal progeny from sucker material obtained from selected plants in private estates were also produced. Table B–IX gives details of cuttings planted, the number rooted upto the end of the year and number dead during the process of hardening.

Treatment given to cuttings: Cut end of suckers were immersed in water as soon as they were severed from the mother plants. Single noded cuttings were prepared from these and were treated with urine extract using the 'quick dip' method prior to planting them in propagation chambers in sand rooting medium provided with moss cover. The cuttings had two leaves at the nodes trimmed to one-third their lengths.

18. A great variation in rooting is observed in cuttings from individual selections. Details of rootings obtained from the cuttings of individual selections are given in Table B–X. It is seen from the table that generally the rooting of cuttings from the robusta selections is better than the rooting of cuttings from arabica selections or Kents arabica.

19. Eight hundred and five clonal plants raised from S. 31 and 23 selected Kent plants, and 625 basket seedlings of S.450 Kents arabica were made available to the Chemistry division for laying out an experiment on manurial requirements of coffee. Details of the plants given over are mentioned below:—

Selections	No. of Plants		Selections	No. of Plants	
	Clones	Seedlings		Clones	Seedlings
450– 2	25	—	450–37	25	—
450– 4	25	—	450–39	25	—
450– 6	24	—	450–40	25	—
450–10	25	—	450–41	25	—
450–12	25	—	450–45	25	—
450–22	25	—	450–47	25	—
450–25	25	—	450–51	50	—
450–26	24	—	450–75	25	—
450–30	24	—	450–86	25	—
450–31	25	—	450–88	25	—
450–33	25	—	S. 31	183	—
450–34	25	—	S. 450	—	625
450–36	50	—	Total ..	805	625

C. **Multiple stem vs. single stem system of growing Coffee.**

ARABICA

20. **Experiment I.**

Locality: Balehonnur (Mysore). *Layout:* AB, BA patern.

Variety: S.288, S.333, S.433, S.434 and Kents (each variety having 12 rows of 16 plants in each row).
Treatments: 2.
Replications: 6.
Plot: 6 × 16.
Spacing: 6 ft. × 6 ft.
Age of plants: 7 years from seed.
Shade: Natural shade.
Period of conversion to multiple stem: May 1950;

Area of the experimental block: 95·2 cents.

Treatments: A. Plants on single stem.
B. Plants on multiple stems (three suckers)

The yield record of plants on single stem and multiple stems are furnished in Table B–XI.

The yield from the multiple stem plots in general does not appear to be much superior to that from the single stem plots. During 1953 the multiple stem plot of S.288 has given over 3 times the yield of the single stem plot of the same variety, though the previous year, it had given less than one-third the yield of the single stem plot. None of the other varieties has given much superior yields from the multiple stem plots over that from the single stem plots.

During the operation of shade regulation, 3 multiple stems were damaged. A sucker from the node lower down to the damaged portion was allowed to develop in each of the 3 stems to continue the growth of the stem. A number of primary branches in the multiple stems of S.433 and S.434 were affected with shot-hole borer infestation. These were promptly removed and destroyed.

After the crop harvest, during February 1953, three lowest pairs of primary branches were pruned off on the multiple stems.

21. **Experiment II**

Locality: Balehonnur (Mysore).
Variety: Arabica (Hybrid).
Treatment: 4 (during the year of conversion).
Replications: 5.
Layout: Randomised block.
Plot: 4 × 16.
Spacing: 6′ × 6′.
Age of plants: 20 yrs. from seed.
Shade: Natural shade.
Period of conversion: March 1951.

Area of experimental block: 105·8 cents.

Treatments:

A. Single stem.

B. Primary branches on one side were pruned off during March 1951, to encourage free development of three suckers for forming the multiple stems. After crop harvest, during March 1952, the main stem was stumped to a height of .2 feet from

the ground level retaining, however, a primary branch to form the lung branch. The three suckers form the multiple stems.

C. Extended centring upto one foot from the centre was done during the year of conversion (1951) to facilitate free development of three suckers for forming the multiple stems. After crop harvest, during March 1952, the main stem was stumped to a height of 2 feet from the ground level retaining, however, a primary branch to form the lung branch. The three suckers form the multiple stems.

D. Except the top two primary branches, all the other branches were cut down during the year of conversion (March 1951) to facilitate free development of suckers. After crop harvest, during March 1952, the topmost primary branch was retained to act as a lung branch and the three suckers form the multiple stems.

The development of suckers for forming the multiple stems is observed to be the best in treatment B. The average yield record from single vs. multiple stem plots in this experiment is furnished in Table B–XII. The yield from the treatments B, C and D which are on multiple stems, is very much lower than the yield from treatment A which is on single stem during the first crop year after conversion.

After the crop harvest, during February 1953, two lowest pairs of primary branches were pruned off on the multiple stems.

22. **Experiment III.**

Lacality: Balehonnur (Mysore).
Variety: Arabica (Hybrid).
Treatment: 2–
A. Single stem.
B. Multiple stems.
Replications: 21.
Period of conversion: March 1951.
Layout: AB, AB, pattern.
Plot: 16 plants in a row.
Spacing: 6 ft. × 6 ft.
Age of plants: 9 years from seed.
Shade: Natural shade.

Area of experimental block: 56·00 cents.

Average yield records from single stem vs. multiple stem plots in this experiment are furnished in Table B–XIII. The yield from multiple stems is lower during the first crop year after the conversion than the yield from single stems. After the crop harvest, during February 1953, two lowest pairs of primary branches were pruned off on multiple stems.

23. **Robusta.**

Locality: Balehonnur (Mysore).
Variety: Robusta.
Layout: Opposite quadrants on a rectangular block are on each of the treatments.

Treatments: 2 –

A. Single stem. *Plot*: 11 × 8.

B. Multiple stem. *Spacing:* 9 ft. × 9 ft.

Replications: 2. *Shade:* Natural shade.

Period of conversion: Sept. 1951.

Age of plants: 7 years from seed.

Area of the experimental block: 65·5 cents.

Average records of yield of the plots in this experiment are furnished in Table B–XIV. The yield from multiple stems is much lower during the first crop year after conversion than the yield from single stems. The primary branches in the multiple stems had a heavy shot-hole borer infestation and these infested branches were promptly removed and destroyed.

4. **Seed germination tests:** Seeds of S.985 prepared during December 1952, were sown every fortnight from 1st January 1953 to end of the official year. The sowings were replicated three times using 100 seeds for each replication. The seeds were sown in nursery beds. These were kept open during the rainy months. The results of germination are tabulated in Table B–XV along with similar data collected in previous years. It is observed that if sowings are delayed, the seeds take a longer time to show the first signs of germination and also there is a gradual deterioration in the germination from later sowings.

D. **Miscellaneous Crops:**

25. **Green manures:** Small specimen plots of the following green manure plants were continued:—

Crotalaria anagyroides.	*Desmodium gyroides.*
C. usaramoensis.	*D. ovalifolium.*
C. Grahamiana.	*Calapagonium mucunoides.*
C. Brownei.	*Canavalia ensiformis.*
C. formosa.	*Centrosema pubesence.*
Tephrosia candida.	*Stylosanthes gracilis.*
T. vogelii.	*Stizalobium sp.*

Stylosanthes gracilis established well as a ground cover and stood up well to the drought conditions.

47½ lb. of seeds of green manure plants were supplied to planters during the year.

26. **Cotton:** (*i*) *Moco* and *Queberdinho* (Perennial cotton) plants continue to show good development. A total quantity of 9¾ lb. of Kappas was collected from the plot. On the advice of the Assistant Botanist (Cotton), Department of Agriculture, Mysore, during his visit to the Station, these plants as well as *St. vincent* and *Montserrat* were stumped during May, 1953, to a height of about 2 feet from ground level. The plants have put forth new flush.

(*ii*) An area of 40 cents was cleared of jungle growth and made available to Assistant Botanist (Cotton), Mysore Department of Agriculture, for laying out small-scale trial plots of *Moco*, *Queberdinho* and *Sea Island* cottons. 170 pits were sown to *Moco*, and *Queberdinho*, the planting distance being 6′ × 6′; and 691 pits were sown to *Sea Island* cotton the planting distance being 3′ × 2′. Seeds were sown during April 1953. On account of the dry condition prevailing, in spite of hand-watering it was not possible to obtain a good stand of plant material. The stand of plants in the plots sown to *Sea Island cotton* is comparatively better than the plots sown to *Moco* and *Queberdinho*. The plants also suffered from the sudden and heavy rainfall that occurred during the S.W. monsoon.

27. **Shade trees**: *Maesopsis eminii* raised from seeds obtained from Kenya are making satisfactory growth and have grown up to 22 feet in height with a spread of 18 feet in four years. They are evergreen and give a light shade for coffee. The branches are observed to be infested with shot-whole borer and on account of this the growth of some of the trees is retarded. 3 lb. of seeds were obtained from the Forest Officer, Nairobi, and supplied to five planters in Coorg, Nilgiris, Shevaroys, Tirunelvely and Anamallais,

Seed of *Inga sp.* (probably Inga punctata Wild.) was obtained from Dr. W. H. Cowgill, Instituto Agropecuario Nacional, Guatemala, and given for trial to 7 planters in Mysore, Coorg, Nilgiris, Shevaroys and Tirunelvely. The germination has been reported a failure in all cases.

Seed samples of *Indigofera Teysmanii*, *Sesbania cinerescence* and *Albizzia sumatra* were received from the Director, Tea Research Institute of Ceylon, and seedlings of these have been raised at the Station.

28. **Other plants**: Specimen of chicory, vanilla, cinnamon and scented geranium has been established and kept growing. 6 lbs. of dry bark of cinnamon was collected from one plant which died on account of root rot, and sold.

R. L. NARASIMHASWAMY,
Assistant Botanist.

TABLE B–I: BREEDING OF ARABICA COFFEE AT BALEHONNUR (MYSORE)

Sl. No.	Method	Purpose	Procedure adopted
1	2	3	4
1	Hybridisation between two desirable parents.	To secure best combination to produce high yield, vigour and resistance to leaf disease.	1) 288, 2/7 x 583, 7/14 2) *a*) 327, 6/4 x 881, 2/8 *b*) 327, 6/4 x 583, 2/4 3) *a*) S.31 x 583, 7/14 *b*) S.31 x 905, 1/7 4) *a*) 333–4 x 583, 1/9 *b*) 333–4 x 583, 6/11

Table B-I: (*Continued*)

Sl. No.	Method	Purpose	Procedure adopted
1	2	3	4
			5) *a*) 333–14 x 583, 7/14 *b*) 333–14 x 574, 4/2 6) *a*) 333–8 x 881. 2/8 *b*) 333–8 x Devamachy hyd. P1. 1 *c*) 333–8 x Devamachy hyd. P1. 2 7) *a*) 645, 1/6 x 583, 2/4 *b*) 645, 1/6 x 831, 4/9 8) *a*) 353, 7/ 6 x 583, 6/11 *b*) 353, 7/6 x 450, 4/2 9) *a*) 574, 4/2 x 333–14 *b*) 574, 4/2 x 446, 1/1 10) *a*) 583, 1/9 x 333–4 *b*) 583, 1/9 x 446, 2/1 *c*) 583, 1/9 x 450, 4/2 11) *a*) 583, 2/4 x 327, 6/4 *b*) 583, 2/4 x 645, 1/6 12) *a*) 583, 6/11 x 353, 7/6 *b*) 583, 6/11 x 450, 4/2 13) *a*) 583, 7/14 x 288, 2/7 *b*) 583, 7/14 x S. 31 *c*) 583, 7/14 x 333–4 14) *a*) 373, 1/3 x 583, 7/14 *b*) 373, 1/3 x 333–14 15) *a*) 446–1/1 x 574, 4/2 *b*) 446–1/1 x 583, 1/9 16) *a*) 450, 2/1 x 583, 1/9 *b*) 450, 2/1 x 905, 1/7 17) *a*) 881, 4/9 x 327, 6/4 *b*) 881, 4/9 x 645, 1/6 18) *a*) 905, 1/7 x 583, 1/9 *b*) 905, 1/7 x 446, 2/1 *c*) 905, 1/7 x 450, 4/2 19) *a*) Devamachy hyb. P1. 1 x 451, 1/16 *b*) Devamachy hyb. P1. 1 x 881, 2/8 *c*) Devamachy hyb. P1. 1 x 333–8 20) *a*) Devamacny hyb. P1. 3 x 881, 2/9 *b*) Devamachy hyb. P1. 3 x 288, 2/5
2	Selfing of desirable plants.	For raising further progeny.	1) 228, 2/5 & 288, 2/7 2) 327, 2/10, 4/15 & 5/5 3) 829, 1/1 & 3/1 4) 737, 3/4 & 4/1 5) 738, 3/3 & 3/6 6) 333–4 & 8 7) 615, 1/6 8) Devamachy hyb. P1. 2, 3 & 4 9) 891, 1/1, 1/2 & 2/2
3	Selfing of desirable types.	To produce seed for supplies to planters.	1) 37 plants in S.288 family (sibs 1 to 37) were covered with muslin bags when they were in blossom. 2) 28 plants in S.795 family (sibs 1 to 28) were covered with muslin bags when they were in blossom. 3) 38 plants in S.645 family (sibs 1 to 38) were covered with muslin bags when they were in blossom. 4) 11 plants in S.333 family (sibs 1 to 11) were covered with muslin bags when they were in blossom.

TABLE B–II: CHARACTER STUDIES OF SOME ARABICA SELECTIONS

Selections	Average of 50 bean measurements in mm. Lengths				Average of 50 bean measurements in mm. Breadths				Ratio of Lgth/ Brdth	
	1952	Std. error	1953	Std. error	1952	Std. error	1953	Std. error	1952	1953
BA. 4	9·8	±0·10	10·2	±0·12	7·4	±0·09	7·5	±0·06	1· 32	1·36
BA. 5	9·9	±0·10	9·5	±0·15	7·3	±0·05	7·1	±0·11	1· 36	1·34
BA. 6	10·2	±0·09	9·9	±0·09	7·3	±0·05	7·2	±0·06	1·397	1·38
BA. 7	10·6	±0·02	10·5	±0·15	7·9	±0·08	8·0	±0·16	1· 34	1·31
BA. 10	10·0	±0·01	9·8	±0·12	7·5	±0·08	7·2	±0·05	1· 33	1·36
BA. 11	9·8	±0·09	9·8	±0·11	7·4	±0·06	7·2	±0·06	1· 32	1·36
BA. 12	9·3	±0·08	9·5	±0·11	7·1	±0·10	7·5	±0·07	1· 31	1·27
BA. 15	9·2	±0·12	9·2	±0·11	7·1	±0·07	6·6	±0·15	1·296	1·39
BA. 16	9·8	±0·07	10·2	±0·07	7·4	±0·02	7·5	±0·05	1· 32	1·36
BA. 17	8·4	±0·12	10·0	±0·12	6·9	±0·07	7·0	±0·16	1·217	1·43
BA. 18	8·6	±0·10	9·2	±0·13	6·9	±0·07	7·0	±0·16	1·246	1·31
BA. 19	9·2	±0·01	9·9	±0·16	6·9	±0·08	7·0	±0·06	1·333	1·41
BA. 22	9·6	±0·32	10·2	±0·08	8·1	±0·01	7·4	±0·09	1·185	1·38
BA. 28	11·2	±0·20	10·6	±0·11	8·1	±0·15	7·2	±0·05	1· 38	1·47
BA. 29	9·8	±0·23	10·2	±0·12	7·7	±0·14	7·5	±0·07	1· 27	1·36
BA. 36	8·5	±0·09	9·0	±0·09	7·4	±0·07	7·5	±0·07	1·148	1·20

TABLE B–III: CLASSIFICATION OF SOME ARABICA SELECTIONS ACCORDING TO BEAN SHAPE

SHAPE OF BEANS					
Longish		Roundish oblong		Roundish	
1952	1953	1952	1953	1952	1953
1	2	3	4	5	6
BA 5	BA 4	BA 4	BA 10	BA 12	BA 12
BA 6	BA 5	BA 10	BA 11	BA 15	BA 15
BA 7	BA 6	BA 11	BA 16	BA 17	BA 36
BA 28	BA 7	BA 16	BA 18	BA 18	
	BA 17	BA 19		BA 36	
	BA 19	BA 22			
	BA 22				
	FA 28				
	BA 29				

BA. 4, BA. 19, BA. 22 and BA. 29 classified during 1952 as *roundish oblong* beans have been classified in 1953 as *longish* beans; BA. 18 classified in 1952 as *rouudish* beans has been classified as *roundish oblong* beans in 1953; and BA. 17 classified in 1952 as *roundish* beans has been classified as *longish* beans in 1953. It is felt that data for a few more years have to be collected before drawing conclusions.

TABLE B–IV: CHHRACTER STUDIES OF PRELIMINARY SELECTIONS FROM NETRACONDA ESTATE (MYSORE)

Characters studied	SELECTIONS					
	Net. A	Net. B	Net. C	Net. D	Net. E	Net. F
a) Actual yield of ripe cherry in oz:						
1950	49	307	304	206	82	158
1951	128	32	54	13	6	48
1952	56	64	50	204	66	74
1953	34	93	108	48	56	32
Average	66·8	124	129	117·75	52·5	78
b) Calculated yield of clean coffee per acre (1,200 plants) in cwt.						
1950	7·3	18·7	26·1	30·2	10·2	16·0
1951	19·5	3·6	3·6	2·0	0·7	4·7
1952	6·0	6·5	4·2	22·8	6·8	7·3
1953	4·2	7·8	7·9	4·5	3·7	2·5
Average	9·25	9·15	10·45	14·9	5·35	7·6
c) Percentage of triage						
1950	15·8	12·6	36·0	31·3	14·3	10·5
1951	10·3	10·0	7·3	29·7	5·3	28·6
1952	14·3	8·3	4·8	20·6	5·3	16·6
1953	24·0	27·7	27·7	37·0	13·6	46·7
Average	16·1	14·65	18·95	29·65	9·63	52·6
d) Percentage of 'A' grade beans						
1950	28·6	17·5	42·7	31·3	39·3	46·3
1951	37·9	30·0	40·0	41·6	55·0	42·8
1952	50·0	50·0	66·7	61·1	68·4	52·4
1953	16·0	25·5	36·2	25·9	22·7	26·7
Average	33·13	30·75	46·4	39·98	46·35	42·05
e) Percentage of Peaberry						
1950	28·6	30·2	15·7	13·5	18·6	25·9
1951	37·9	20·0	22·9	7·1	40·0	14·2
1952	32·1	16·7	23·1	16·8	21·1	31·5
1953	24·0	17·0	14·9	14·8	13·6	13·3
Average	30·65	20·98	19·15	13·05	23·32	21·22

N.B.—Clean coffee is calculated on the actual out-turn of coffee from ripe cherry harvested.

TABLE B–V: CHARACTER STUDIES OF SOME ROBUSTA SELECTIONS

Selection	Average of 50 bean measurements in mm.								Ratio of Lgth/Brdth	
	Length				Breadth					
	1952	Std. error	1953	Std. error	1952	Std. error	1953	Std. error	1952	1953
BR. 2	9·2	±0·07	9·4	±0·09	7·7	±0·04	7·4	±0·06	1·19	1·27
BR. 4	8·7	±0·06	8·6	±0·05	6·0	±0·05	6·7	±0·04	1·45	1·28
BR. 5	8·8	±0·07	8·7	±0·09	6·0	±0·05	5·9	±0·05	1·46	1·47
BR. 6	8·3	±0·08	8·0	±0·09	6·5	±0·06	6·3	±0·04	1·28	1·27
BR. 8	10·9	±0·17	8·7	±0·02	6·9	±0·09	6·5	±0·04	1·58	1·34
BR. 9	8·9	±0·07	9·0	±0·02	7·1	±0·06	7·2	±0·05	1·25	1·25
BR. 10	8·9	±0·08	8·6	±0·10	6·6	±0·05	6·5	±0·05	1·35	1·32
BR. 11	9·5	±0·07	8·9	±0·06	7·4	±0·06	7·2	±0·05	1·27	1·24
BR. 14	8·7	±0·07	8·4	±0·09	6·4	±0·06	6·0	±0·06	1·36	1·40
BR. 15	—	—	9·0	±0·06	—	—	6·5	±0·04	—	1·38

TABLE B–VI: CLASSIFICATION OF SOME ROBUSTA SELECTIONS ACCORDING TO SHAPE

SHAPE OF BEANS			
Longish		Roundish Oblong	
1952	1953	1952	1953
BR. 4	BR. 5	BR. 2	BR. 2
BR. 5	BR. 10	BR. 6	BR. 4
BR. 8	BR. 14	BR. 9	BR. 6
BR. 10	BR. 15	BR. 11	BR. 8
BR. 14			BR. 9
			BR. 11

It is seen from the table that BR. 4 and BR. 8 classified as *longish* beans in 1952 have been classified as roundish beans in 1953. It is felt that data for a few more years have to be collected before conclusions can be drawn.

TABLE B–VII: SEED COFFEE DISTRIBUTION

Year	Quantity of seed coffee supplied from										Total	
	Arabica Selections		Kents Arabica		S. 274 robusta		Robusta		Excelsa			
	lb.	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*	*lb.*	*oz.*
1949	150	0	262	8	62	0	759	0	2	9	1236	1
1950	253	0	173	5½	47	9	506	3		—	980	1½
1951	400	0	366	0	40	4	1045	12	1	0	1853	0
1952	695	13	80	9	45	1	1139	7½	7	8	1968	6½
1953	888	0½	45	6	35	2	875	6	9	8	1853	6½
Total ..	2386	13½	927	12½	230	0	4325	12½	20	9	7890	15½

TABLE B–VIII: SEEDS SUPPLIED TO REGIONAL NURSERIES, SEEDLINGS RAISED THERIN AS AT THE END OF THE YEAR AND SEEDLINGS DISTRIBUTED TO PLANTERS DURING THE YEAR

Sl. No.	Regional Nursery	Arabica selections	S. 274 Robusta selection	Total
	1	2	3	4
	Mysore			
1	Murkull Estate, Javali P.O.			
	Seeds supplied.	38 oz.	—	38 oz.
	Seedlings raised.	2400	—	2400
	Seedlings distributed.	2000	500	2500
2	Mandalkhan Estate, Santaveri P.O.			
	Seeds supplied.	38 oz.	—	38 oz.
	Seedlings raised.	1000	—	1000
	Seedlings distributed	1200	—	1200

Table B–VIII : (*Continued*)

Sl. No.	Regional Nursery	Arabica selections	S. 274 Robusta selection	Total
	1	2	3	4
3	Coffee Research Station, Balehonnur.			
	Seedlings raised.	4500	—	4500
	Seedlings distributed.	4460	—	4460
	Coorg			
4	Nullore Estate, Suntikoppa P.O.			
	Seeds supplied.	—	—	—
	Seedlings raised.	—	—	—
	Seedlings distributed.	4273	937	5210
5	Madapur Estates, Madapur P.O.			
	Seeds supplied.	38 oz.	—	38 oz.
	Seedlings raised.	1500	—	1500
	Seedlings distributed.	1250	800	2050
	Nilgiri-Wynaad			
6	Glenvans Estate, New Hope P.O.			
	Seeds supplied.	38 oz.	—	38 oz.
	Seedlings raised.	3400	—	3400
	Seedlings distributed.	1640	—	1640
	Nilgiris			
7	Adderly Estate, Coonoor P.O.			
	Seeds supplied.	38 oz.	—	38 oz.
	Seedlings raised.	3500	—	3500
	Seedligs distributed.	1200	—	1200
	Biligiri Rangans			
8	Honnametty Estate, Attikan P.O.			
	Seeds supplied.	—	—	—
	Seedlings raised.	—	—	—
	Seedlings distributed.	3266	—	3266
	Shevaroys			
9	Hawthrone Estate, Yercaud P.O.			
	Seeds supplied.	—	—	—
	Seedlings raised.	70	700	770
	Seedlings distributed.	3600	1620	5220
	Anamalais			
10	Waverly Estate, Attakatti P.O.			
	Seeds supplied.	38 oz.	—	38 oz.
	Seedlings raised.	1070	—	1070
	Seedlings distributed.	—	—	—
	Tirunelveli			
11	Singampatty Group Estate, Kalladakurichi P.O.			
	Seeds supplied.	38 oz.	—	38 oz.
	Seedlings raised.	2080	—	2080
	Seedlings distributed.	—	—	—

TABLE B–IX : ROOTING OF SINGLE-NODED LEAFY SUCKER CUTTINGS

Sl. No.	Selections	No. of cuttings planted	No. of cutting rooted & transplanted to nursery beds till 30-6-53	No. dead during the hardening process	No. of clonal plants existing on 30-6-53	Percentage of plants existing
1	Arabica cultures (B.A. series)	1795	772	109	663	36·9
2	S. 26	200	125	4	121	60·5
3	S. 31	786	227	9	218	27·7
4	S. 795	167	99	13	86	51·5
5	Arabica plants marked in private estates	373	187	53	134	35·9
6	Kents Arabica	2460	1426	225	1201	48·8
7	Robusta cultures (B.R. series)	660	441	51	390	59·1
	Total	6441	3277	464	2813	43·67

50·87 per cent cuttings rooted of which during the hardening process in the nursery beds, 7·2 per cent died thus giving a net result of 43·67 per cent. Though the highest percentage of rooting is shown by S. 26, generally the rooting of cuttings from robusta selections appears to be better than that of either arabica selections or Kents arabica.

TABLE B–X: ROOTING OF CUTTINGS FROM INDIVIDUAL SELECTIONS

Selections	Number of Cuttings			No. of rooted cuttings existing as on 30-6-53	Percentage	Percentage obtained in previous year
	Planted	Rooted & transplanted to nursery beds	Died during the hardening process			
1	2	3	4	5	6	7
Arabica :						
BA. 2	16	1	—	1	6·25	83·3
BA. 3	36	10	1	9	25·0	45·0
BA. 4	43	16	5	11	25·60	51·7
BA. 6	13	1	1	—	—	27·8
BA. 7	87	26	7	19	21·80	14·1
BA. 8	71	46	8	38	53·50	30·1
BA. 9	107	53	8	45	42·10	42·3
BA. 10	22	15	3	12	54·50	73·0
BA. 11	57	22	—	22	38·60	36·1
BA. 12	57	40	8	32	56·10	88·4
BA. 13	83	26	7	19	22·90	38·1
BA. 14	41	12	—	12	29·30	31·7
BA. 15	33	10	2	8	24·20	42·7
BA. 16	41	26	11	15	36·60	39·4
BA. 17	84	25	3	22	26·20	65·6
BA. 18	109	32	3	29	26·60	45·7
BA. 19	75	27	2	25	33·30	93·4
BA. 21	112	13	4	9	8·03	14·7

Table B–X: (*Continued*)

Selections	Number of Cuttings			No. of rooted cuttings existing as on 30-6-53	Percentage	Percentage obtained in previous year
	Planted	Rooted & transplanted to nursery beds	Died during the hardening process			
1	2	3	4	5	7	6
BA. 22	104	66	2	64	61·50	34·2
BA. 25	76	46	8	38	50·00	16·8
BA. 27	89	41	3	38	42·70	72·5
BA. 28	57	34	2	32	56·10	50·0
BA. 29	51	13	1	12	13·50	52·2
BA, 30	65	59	5	54	83·10	66·7
BA. 31	62	2	—	2	3·20	20·0
BA. 32	46	3	1	2	4·35	21·4
BA. 33	10	1	—	1	10·00	63·6
BA. 34	48	20	2	18	37·50	62·9
BA. 36	26	5	4	1	3·80	55·9
S. 26	200	125	4	121	60·50	78·0
S. 31	786	227	9	218	27·70	65·0
Kents :						
450– 6	12	12	—	12	100·00	89·3
–12	98	55	3	52	53·10	60·7
–15	12	12	2	10	83·33	44·7
–16	54	8	8	—	—	71·0
–22	76	38	7	31	40·80	43·1
–23	32	30	1	29	90·60	58·1
–24	48	27	19	8	16·67	75·8
–25	147	38	—	38	25·85	56·3
–26	244	61	2	59	25·00	53·2
–30	82	62	29	33	40·24	75·8
–31	98	35	21	14	14·29	73·7
–34	33	6	—	6	18·18	83·3
–35	53	19	2	17	32·08	64·1
–36	16	15	3	12	75·00	73·5
–37	59	26	3	23	38·98	96·2
–39	33	7	—	7	21·21	62·2
–45	112	47	6	41	36·61	77·6
–59	108	26	—	26	24·07	31·1
–60	68	29	3	26	38·24	89·3
–62	75	40	3	37	48·33	55·6
–63	99	32	—	32	32·32	65·8
–66	112	24	—	24	21·43	42·1
–69	43	24	—	24	55·81	26·7
–70	62	36	5	31	50·00	12·5
–71	58	26	—	26	44·83	23·3
–73	80	30	—	30	37·50	51·0
–75	66	31	6	25	37·90	61·0
–86	79	41	2	39	49·37	69·5
–88	104	20	1	19	18·27	59·5
Robusta :						
BR. 1	54	20	3	17	31·5	50·0
BR. 2	28	26	—	26	92·8	81·3
BR. 3	28	24	2	22	78·6	80·0
BR. 4	72	72	8	64	88·9	86·7
BR. 5	75	53	4	49	65·3	25·0
BR. 6	29	24	5	19	65·5	53·9
BR. 7	20	15	1	14	70·0	60·0
BR. 8	6	3	—	3	50·0	86·7
BR. 9	26	22	3	19	73·1	80·0
BR. 10	84	50	4	46	54·8	62·7
BR. 11	50	27	1	26	52·0	86·7
BR. 12	24	9	1	8	33·3	100·0
BR. 14	108	57	11	46	42·6	64·2
BR. 15	44	24	3	21	47·7	50·0
BR. 17	12	8	2	6	50·0	89·3

TABLE B–XI: YIELD RECORD OF PLANTS ON SINGLE STEMS AND MULTIPLE STEMS

Plot No.	Variety	Yield of ripe cherry (actual) in lb. and calculated yield of clean coffee in cwt. per acre (1200 plants)											
		A. Single Stem Plots						B. Multiple Stem Plots					
		Ripe Cherry			Clean Coffee			Ripe Cherry			Clean Coffee		
		1952 lb. oz.	1953 lb. oz.	Average lb. oz.	1952 Cwt.	1953 Cwt	Average Cwt.	1952 lb. oz.	1953 lb. oz.	Average lb. oz.	1952 Cwt.	1953 Cwt.	Average Cwt.
1	S. 288	63– 1	54–12	58–14½	1·17	1·00	1·085	20– 8	176– 9	98– 8½	0· 38	3·28	1· 83
2	S. 333	82– 8	98– 2	90– 5	1·53	1·82	1·675	8– 3	82– 8	45– 5½	0· 15	1·53	0· 84
3	Kents	18–12	32– 0	25– 6	0·35	0·60	0·475	6–15	27–12	17– 5½	0· 13	0·52	0·325
4	S. 433	7– 3	103– 0	55– 1½	0·13	1·92	1·025	3–14	98– 8	51– 3	0· 07	1·83	0· 95
5	S. 434	22– 6	116– 0	69– 3	0·42	2·16	1·290	5– 1	135– 7	70– 4	0· 09	2·52	1·305
6	Kents	21–10	10– 0	15–13	0·40	0·18	0·290	3– 6	8– 0	5–11	0· 06	0·15	0·105
	Mean	35–14·7	68–15·7	52– 7	0·67	1·06	0·865	7–15·8	88– 2	48– 1	0·149	1·63	0·889

N. B.—6 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee for purposes of calculation.

TABLE B–XII: AVERAGE RECORD OF YIELD FROM SINGLE VS. MULTIPLE STEM PLOTS

Treatment	Yield of ripe cherry (actual) in lb. & calculated yield of clean coffee in cwt. per acre (1200 plants)			
	Ripe Cherry (actual)		Clean Coffee	
	1952 (Conversion year)	1953	1952 (Conversion year)	1953
	lb.	*lb.*	*cwt.*	*cwt.*
A.	38·63	47·14	1·08	1·31
B.	22·11	12·24	0·70	0·34
C.	24·62	26·11	0·78	0·73
D.	38·38	34·73	1·07	0·97

N. B.—6 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee for purposes of calculation.

TABLE B–XIII: AVERAGE RECORD OF YIELD FROM SINGLE VS. MULTIPLE STEM PLOTS

Treatment	Ripe cherry (actual) in lb.		Calculated yield of clean coffee per acre (1200 plants)	
	1952 (Conversion year)	1953	1952 (Conversion year)	1953
	lb.	*lb.*	*cwt.*	*cwt.*
A. Single Stem.	5·78	19·43	0·64	2·17
B. Multiple Stem.	3·90	8·03	0·44	0·89

N. B.—6 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee for purposes of calculation.

TABLE B–XIV: AVERAGE RECORD OF YIELD FROM SINGLE VS. MULTIPLE STEM PLOTS

Treatment	Ripe cherry (actual) in lb.	Calculated yield of clean coffee per acre (538 plants) in cwt
A. Single Stem	121·06	1·33
B. Multiple Stem	52·69	0·58

N.B.—5 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee for purposes of calculation.

TABLE B–XV: GERMINATION PERCENTAGE OF COFFEE SEEDS SOWN IN NURSERY BEDS

Date of sowing	Percentage of germination (average of 3 replns.) from S. 288	Date of sowing	Percentage of germination (average of 3 replns.) from S. 645	Date of sowing	Percentage of germination (average of 3 replns.) from S. 985
1–1–1951	81	1–1–1952	96·33	1–1–1953	94·67
15–1–1951	98	15–1–1952	95·33	15–1–1953	98·67
1–2–1951	95	1–2–1952	98·33	1–2–1953	89·67
15–2–1951	96	15–2–1952	92·00	15–2–1953	85·00
1–3–1951	91	1–3–1952	93·00	1–3–1953	80·00
15–3–1951	93	15–3–1952	87·67	15–3–1953	81·66
1–4–1951	93	1–4–1952	88·33	1–4–1953	Not sown
15–4–1951	81	15–4–1952	71·33	15–4–1953	Not sown
1–5–1951	78	1–5–1952	51·00	1–5–1953	64·33
15–5–1951	Not sown	15–5–1952	51·00	15–5–1953	44·66
1–6–1951	Failed to	1–6–1952	50·33	1–6–1953	Failed to
15–6–1951	germinate	15–6–1952	16·67	15–6–1953	germinate

II. CHEMISTRY

A. Field Experiments.

(a) *Manurial Experiments:*

(i) *New Manurial Series:* The experiment laid out in 1937 at the Coffee Research Station, Balehonnur was continued. Four plants, three in the outer border and one in the sub-plot were attacked by white stem borer and were removed. The plant in the border row corresponding to the plant in the plot was removed and planted inside the plot. The vacancies in the border were planted with plants from the reserve plot next to the New Manurial Series Plots. 20 lb. of nitrogen per acre in the form of Urea was applied to the plants in the N, NP, NK and NPK sub-plots in the month of March 1953. The major portion of the bamboos on the pandal was replaced with new bamboos. All other cultural operations were carried out in time.

(ii) *Fundamental manurial experiments in the pH cisterns:* The experiments laid out in 1950 at the Coffee Research Station, Balehonnur was continued. Three plants which had developed leaf disease were removed and the vacancies thus caused planted with S.31 clones of the same age from the 8 acre area. Manuring was done in October 1952 and May 1953 as per programme. As rock phosphate arrived only in June 1953, application of phosphate was carried out then. All other cultural operations were carried out in time.

(iii) *17–acre Manurial experiments – 1952 series:* A new manurial experiment was started in the area cleared on the 17–acre plot next to the New Manurial Series in the early part of 1952. In this trial the effect of 40, 60, 80, 100 lb. of nitrogen with 30 lb. of P_2O_5 and 40 lb. K_2O per acre, on the growth, yield and quality of coffee is being studied. Each mother plant is represented equally in all the sub-plots; thus plant material is uniform in all plots. A row of Kent seedlings has been planted round the nett sub-plots and a row of clones of S.31 has been planted all round the plot to form a general guard row. Dadap stakes were planted 12′ apart to provide temporary shade. One plant each of *Ficus glomerata*, *F. nervosa*, *Bischofia javanica* and one stake of *Ficus retusa* were planted in each plot in the 4 corners at the cross section of diagonals. A general application at 20 lb. nitrogen per acre as Urea was given to all the plants. All cultural operations were carried out in time.

(iv) *17–acre Manurial Experiments (1953-clearing):* In this experiment the effect of application of 70 lb. of nitrogen per acre in the form of (*a*) Am_2SO_4, (*b*) Urea, (*c*) Chilean Nitrate, (*d*) Calcium cyanamide or nitrochalk along with 30 lb. P_2O_5 and 40 lb. K_2O per acre, on the growth, yield and quality of coffee as compared with 'Control or No manure' is to be studied. An area measuring $1\frac{1}{4}$ acres adjacent to the 1952 clearing was utilized and all coffee growing in the area cut and removed in February. The shade trees were clean pulled out by the roots using a monkey-winch and dragged to the road in March. Pits for planting were opened in June.

(v) *Catalyzed manures:* This experiment which was commenced in 1949 to study the effect of certain catalysts on the mobilization of plant foods and their effect on yield of coffee, was continued. As however, it was decided not to continue the experiment after the 1952–53 crop, the plots were not manured.

The results of manurial experiments and relevant observations on the occurrence of lights in the yield are furnished in the annexed tables.

TABLE C–I: YIELD RECORD OF PERMANENT MANURIALS. COFFEE RESEARCH STATION, BALEHONNUR

Annual rate of manuring N (from 1941 to 1949) = 20 lbs per acre
(from 1950) = 40 lbs ,,
P_2O_5 = 30 lbs ,,
K_2O = 40 lbs ,,

Area of Experimental Block: 76 cents. *Lay-out:* Latin square 5 × 5.
No. of plants per sub-plot: 5 × 8. *Spacing:* 5′ × 5′.
Variety: Kents arabica. *Guard rows:* One row all around the block.
Shade: Artificial. Bamboo slats on Pandal.

Year	Average yield of ripe cherry in lb. & clean coffee in cwt. calculated per acre					Std. error expressed as % gen. mean	Critical diff. P = 0.05	Significant or not	Conclusions
	Treatments								
	N	NP	NK	NPK	Control				
	A	B	C	D	E				
1941 Ripe Cherry	791	663	918	918	553	21·8	513	No	CDABE
1942 ,,	1250	1207	1335	1360	740	11·8	436	Yes	DCABE
1943 ,,	60	89	113	85	43	17·9	16	Yes	CBDAE
1944 ,,	255	213	306	264	204	19·0	147	No	CDABE
1945 ,,	1155	1132	1519	1744	736	26·9	1040	No	DCABE
1946 ,,	400	531	332	595	510	27·4	411	No	DBEAC
1947 ,,	468	697	714	697	587	4·9	379	No	CDBEA
1948 ,,	281	306	306	255	272	17·1	498	No	BCAED
1949 ,,	489	655	483	761	674	8·2	107	Yes	DEBAC
1949 Clean coffee cwts	0·625	0·83	0·688	0·83	0·964	1·2	0·294	Yes	EDBCA
1950 Ripe cherry	1776	1836	1700	1734	1598	9·4	455	No	BADCE
,, clean coffee cwts	2·59	2·60	2·46	2·52	2·23	9·63	0·737	No	BADCE
1951 Ripe cherry	562	396	540	273	229	22·02	270	Yes	ACBDE
,, clean coffee cwts	0·891	0·602	0·821	0·396	0·330	23·65	0·442	Yes	ACBDE
1952 Ripe cherry	2371	2312	2286	2329	1530	10·51	701	Yes	ADBCE
,, clean coffee cwts	3·534	3·382	3·306	3·355	2·179	10·59	1·024	Yes	ABDCE
1953 Ripe cherry	502	396	477	464	324	25·04	334	No	ACDBE
,, clean coffee cwts	0·800	0·612	0·743	0·716	0·488	25·99	22·8	No	ACDBE
Average for 13 years – (Ripe cherry)	728	744	791	822	566	9·40	211	Yes	DCBAE

As has already been stated the 1952-53 arabica crop was a very poor one. The yield record is very low. The treatments have not been significant. However, the trend continues to be the same as in 1951 and treatment A is numerically superior to all others. The treatments are also numerically superior to *Control–no manure*. In the analysis of the average yield for 13 years the results follow the same trend as for 12 years. Treatments D (NPK) and C (NK) are significantly superior to treatment E (Control) but not superior to treatment A (N only) and treatment B (NP).

The following table summarizes the average N. P. K. content of the soil from the several treatments—

TABLE C–II : ANALYSIS OF SOIL SAMPLES FROM PERMANENT MANURIAL EXPERIMENTS, BALEHONNUR – NEW MANURIAL SERIES (1937)

(mgms per 100 gms. oven dry soil)

Year	Treatments	0–9″			9–18″		
		N_2	P_2O_5	K_2O	N_2	P_2O_5	K_2O
1950—	N only	260	67·6	130	212	70·9	247
	N+P	244	99·5	216	228	97·4	903
	N+K	269	100·0	110	209	49·6	135
	N+P+K	251	98	111	203	114·0	142
	Control	262	119	129	206	90·7	81·8
1951—	N only	235	90·3	321	198·4	79·8	348
	N+P	254	108	294	205	113	275
	N+K	235	98·1	329	205	131	275
	N+P+K	251	188	379	207	176	388
	Control	286	86·1	293	203	30·3	382
1952—	N only	201	85·7	237	194	47·6	201
	N+P	209	61·5	246	196	53·5	231
	N+K	193	56·9	223	176	54·5	254
	N+P+K	206	63·4	235	214	53·3	212
	Control	203	48·0	237	187	42·7	225

Catalyzation of plant nutrients: In co-operation with the Bio-Chemistry Department of the Indian Institute of Science, Bangalore, an experiment to test the effect of certain catalysts on the availability of plant *nutrients* in the manures applied was laid out in 1948. The first application of manures was done in June 1948. The results recorded below are from the harvests of 1949, 1950, 1951, 1952 and 1953.

Locality: L–1 block of the Coffee Research Station, Balehonnur.

Annual rate of manuring:

(*a*) Nitrogen 20 lb. per acre, 15 lb. as groundnut oil cake, 5 lb. as ammonium sulphate.

(*b*) P_2O_5 30 lb. per acre as superphosphate or steamed bonemeal.

(*c*) K_2O 40 lb. per acre as cherry husk ash or muriate of potash.

In conformity with the increased dose of nitrogen given to other manurial experiments, the annual dose of nitrogen was increased to 40 lb. per acre.

In addition, certain catalysts (certain chemicals in very fine state of sub-division) are applied mixed with the manures to the sub-plots.

Treatments: General manurial mixture containing 40 lb. N_2, 30 lb. P_2O_5 and 40 lb. K_2O (per acre of 1200 plants) to all the sub-plots.

A. Proprietory Product A at 40 lb. per acre.

B. Proprietory Product B at 80 lb. per acre.

C. Ferrous sulphate at 28 lb. do

D. Potassium permanganate at 20 lb. do

E. Control (no catalyst added).

TABLE C–III : YIELD OF COFFEE IN RELATION TO APPLICATION OF CATALYZED MANURES

Year	Average yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre. Treatments					Std. error expressed % gen. mean	Critical dif. P = 0.05	Sig or not	Conclusion
	A	B	C	D	E				
1949:									
Ripe cherry	498	504	456	480	480	49·1	74	No	$\overline{\text{BADEC}}$
Clean coffee	0·813	0·893	0·508	0·732	0·758	18·05	0·41	No	$\overline{\text{BAEDC}}$
1950:									
Ripe cherry	672	624	498	798	558	19·21	374	No	$\overline{\text{DABEC}}$
Clean coffe	0·929	0·804	0·696	1·00	0·732	20·93	0·545	No	$\overline{\text{DABEC}}$
1951:									
Ripe cherry	744	780	678	816	816	19·14	753	No	$\overline{\text{DEBAC}}$
Clean coffee	1·112	1·112	0·952	1·113	1·112	18·83	0·629	No	$\overline{\text{DABEC}}$
1952:									
Ripe cherry	3872	3600	3024	3560	3682	9·922	960·9	No	$\overline{\text{AEBDC}}$
Clean coffee	6·06	5·118	4·336	5·196	5·158	10·07	1·409	Yes	$\underline{\text{ADEBC}}$
1953:									
Ripe cherry	36·1	24·7	26·9	53·8	7·2				

Lights in relation to manurial experiment: During the harvest of the New Manurial Series (1937) plots at Balehonnur, the floats content of the produce was determined both by weight and by volume. The results obtained with that for the earlier years from 1949 are tabulated below.

TABLE C–IV : PERCENTAGE OF FLOATS IN MANURIAL EXPERIMENTS

Year	Treatments					Std. error % gen mean	Crit. dif. P = 0.05	Sig. or not	Conclusions
	N (A)	N+P (B)	N+K (C)	N+P+K (D)	CONTROL (E)				
By Weight									
1949	5·4	3·8	8·0	9·8	5·4	32·56	7·92	No	$\overline{\text{DCAEB}}$
1950	7·31	8·7	7·29	7·9	8·83	9·11	2·25	No	$\overline{\text{EBDAC}}$
1951	6·25	6·77	4·52	6·44	5·02	20·37	6·06	No	$\overline{\text{CEADB}}$
1952	5·25	5·88	5·77	6·21	7·67	9·84	1·89	Yes	$\underline{\text{EDBCA}}$
1953	5·80	6·21	6·65	6·35	6·68	4·04	0·803	Yes	$\underline{\text{ECDBA}}$

Table C–IV : (*Continued*)

Year	Treatments					Std. error % gen mean	Crit. dif. P = 0.05	Sig. or not	Conclusions
	N (A)	N+P (B)	N+K (C)	N+P+K (D)	CONTROL (E)				
				By Volume					
1949	3·62	2·91	5·77	6·51	7·02	38·24	0·06	No	EDCAB
1950	8·35	9·42	7·98	9·29	9·19	7·71	2·15	No	DEBAC
1951	3·91	3·58	3·02	4·39	3·05	20·07	2·22	No	CEBAD
1952	6·90	7·63	7·35	7·85	8·58	5·48	1·29	Yes	EDBCA
1953	6·36	6·91	7·26	6·78	7·40	5·48	1·17	No	ECBDA

It is seen that during the year under report, the trend is again that treatment E (control) has a noticeably higher percentage of floats than A (Nitrogen only). Treatment C (N+K) has also a higher percentage of floats than A (N only). In the determination of floats by volume there is no significant difference between treatments. Treatment E (Control) has, however, numerically greater percentage of floats.

Fundamental manurial experiments – Balehonnur:—In accordance with the recommendations of the Expert Committee, a fundamental experiment on manuring was started at Balehonnur using the 36 cisterns which were built earlier to study the effect of varying pH on growth of coffee. Clonal material from S.31 was planted in 1949 and manurial applications started in 1950. It is programmed to pick the first crop in 1953, the flower buds having been rubbed off in 1952. The following table gives in brief the plan, layout and objectives of the trial.

Locality: Coffee Research Station, Balehonnur pH cisterns.

Variety: Coffee arabica clones from S.31.

Treatments: 6. Shade: Artificial using coir netting.
Plot: Single plant. Size of each cistern: 6′ × 6′.
Replications: 6. Area: 36 square feet.
Layout: Latin square.
Masonry walls separate the plants from one another.

Treatments:

Manurial Scheme

A.	Nitrogen	20 lb.	P_2O_5	30 lb.	K_2O	40 lb. per acre.
B.	,,	30 lb.	,,	30 lb.	,,	40 lb. ,,
C.	,,	45 lb.	,,	30 lb.	,,	40 lb. ,,
D.	,,	30 lb.	,,	45 lb.	,,	40 lb. ,,
E.	,,	30 lb.	,,	45 lb.	,,	60 lb. ,,
F.	,,	45 lb.	,,	67·5 lb.	,,	90 lb. ,,

Nitrogen is given half as groundnut oil cake and half as ammonium sulphate. Half the nitrogen is applied premonsoon and half post-monsoon. Phorphoric acid and potash are given pre-monsoon mixed with nitrogenous manure and applied in the form of a broad band alround the plant. Phosphoric acid is given in the form of steamed bonemeal and potash in the form of muriate of potash.

From 1952, however, the nitrogen is given in the inorganic form as ammonium sulphate (in pre-monsoon and postmonsoon) and as Urea (in pre-monsoon of 1953).

Soil samples are drawn periodically once before the application of manures in May and again after the monsoon before the second application of nitrogenous manures in postmonsoon period to assess the proportion of plant foods used by coffee and that lost by leaching.

The following table gives the average NPK content of the soil samples for each treatment.

TABLE C–V

Average N P K content of soil in Cisterns oven dry basis (mgms in 100 gms of oven dry soil)

		A	B	C	D	E	F
			October 1950				
0–9″	N_2	209	184	177	185	155	188
	P_2O_5	89·1	88·0	90·2	87	76	89
	K_2O	253	254	255	245	194	246
9–18″	N_2	229	242	240	238	205	215
	P_2O_5	81	79	93	87	81	71
	K_2O	183	212	222	155	191	168
			April 1951				
0–9″	N_2	191	192	220	201	214	219
	P_2O_5	65·6	62·8	70·9	67·4	62·2	62·0
	K_2O	145	178	187	174	195	161
9–18″	N_2	179	168	179	166	201	166
	P_2O_5	59·2	69·7	65·6	60·6	74·9	66·5
	K_2O	224	224	245	204	236	241
			October 1951				
0–9″	N_2	205	205	210	205	217	208
	P_2O_5	98·1	75·7	85·9	73·3	79·1	82·9
	K_2O	218	233	239	204	197	244
9–18″	N_2	193	190	193	197	204	197
	P_2O_5	63	69	56·6	67·2	66·0	67·5
	K_2O	194	182	187	183	186	185
			April 1952				
0–9″	N_2	255	239	245	249	228	239
	P_2O_5	79·3	81·2	90·6	81·8	78·1	81·5
	K_2O	185	195	182	213	204	180
9–18″	N_2	231	219	237	242	233	231
	P_2O_5	58·1	64·5	70·6	66·4	60·3	65·6
	K_2O	230	209	242	227	234	232
			October 1952				
0–9″	N_2	195	190	185	190	190	184
	P_2O_5	83·0	85·0	90·6	68·2	86·5	97·3
	K_2O	186	195	163	176	170	196
9–18″	N_2	177	173	170	172	169	180
	P_2O_5	60·9	59·6	69·7	69·2	65·5	63·4
	K_2O	158	168	151	148	181	159

A further set of samples drawn in April, 1953 is under examination. Results will be discussed and reviewed after those figures are also available.

B. Exploratory Trials.

Methods of accelerating the process of preparing parchment coffee:

The usual method of preparing parchment coffee consists in pulping the ripe fruit to remove the skin, draining the water from the parchment, heaping and covering it and after natural fermentation washing and drying in the sun. Owing to various climatic and other causes the process of fermentation is often prolonged resulting in what is called foxy coffee which is of very poor quality. In addition, when the fermentation process is prolonged, the fermentation vats get cluttered up and throw out of gear the harvest programme involving losses. In order to find out a quick aud easy method of fermenting or removing the mucilaginous material, trials were undertaken in the laboratory and in the field.

'Benefax', a proprietory pectic enzyme marketed by Messrs. Standard Brands Inc. of New York was used. Preliminary trials were conducted in the laboratory to find out the optimum strength of 'Benefax' suitable for fermenting arabica coffee under Indian conditions. The following statement gives the observations recorded.

Sl. No.	Treatment	Initial Temperature	Final Temperature	Initial pH	Final pH	Time taken for washing
1	1/20% Benefax	68·9°F	71·6°F	6·2	5·2	6 hours
2	1/40% ,,	68·9°F	71·6°F	6·2	5·2	6½ ,,
3	1/80% ,,	68·9°F	71·6°F	6·2	5·2	7 ,,
4	Control	68·9°F	66·2°F	6·5	5·2	22 ,,

REMARKS: The treatments were applied at 9-30 a.m. and the samples were allowed to ferment in bamboo baskets. The control washed only early next morning and therefore final temperature was low.

This trial showed that 1/80% Benefax on the weight of wet parchment was an optimum concentration consistent with costs.

Large-scale trials were conducted at two estates situated at two different localities and two different elevations.

Merthikhan Estate: 8,000 lb. of ripe cherry were pulped and yielded 3847·5 lb. of wet parchment. 218·3 gms. of Benefax (1/80% by weight of wet parchment) were then thoroughly incorporated with coffee, the coffee heaped and covered with gunny sacks The treatment was given at 6-30 p.m. and the temperature of the parchment immediately after mixing was 19°C. Periodically samples of parchment were examined to find out if coffee was ready for washing. The parchment was ready for washing the next day at 6-30 a.m. and the temperature of the fermenting mass was 19·5°C as against 17·5°C, the prevalent atmospheric temperature. During the night which was chill and windy, the minimum temperature recorded was 15°C. Thus the parchment washed after 12 hours after treatment whilst the number of hours taken to ferment coffee on the estate during the season was 36–48 by the usual process.

Balur Estate: 2,280 lb. of cherry were pulped and 911·25 lb. of wet parchment obtained. Out of this 675 lb. were treated with 30·6 gms of Benefax (1/100% by weight of wet parchment) by thoroughly mixing the Benefax with the wet parchment. The temperature after mixing was 25·5°C. The parchment was ready for washing at 9 a.m. next day and the temperature at time of washing was 20°C, the same as the atmospheric temperature. Thus, the treated parchment washed after 14 hours after treatment while the untreated control was still not ready for washing then.

In addition to the above trials small scale experiments were also conducted to assess the comparative efficiency of Benefax and a pectic enzyme prepared by the National Chemical Laboratories, Poona. Two sets of trials were run. In the first set, the parchment after pulping was given a wash, drained and then treated with the enzyme preparations. In the second set the enzyme preparations were added immediately after pulping without any preliminary wash. The treatment given and the time taken for fermenting the mucilaginous matter are given below.

Sl. No.	TREATMENT	Time taken for complete fermentation
1	1/80% by weight Benefax A 1	7 hours
2	1/40% ,, ,, A 2	6½ ,,
3	1/20% ,, ,, A 3	6 ,,
4	1/20% ,, pectic Enzyme from National Chemical Laboratory Poona A 4	7 ,,
5	Control (No treatment)	22 ,,
6	1/80% by weight Benefax after washing parchment B 1	6 ,,
7	1/40% ,, ,, ,, B 2	6 ,,
8	1/20% ,, ,, ,, B 3	5½ ,,
9	1/20% ,, Pectic Enzyme from N.C.L., Poona B 4	6½ ,,
10	Control (no treatment)	21½ ,,

It was observed that treatments under B (application of treatments after washing the fresh parchment once) washed better and quicker than those under A. The pH and temperature of the fermenting parchment were read off at periodical intervals. The observations recorded are given in appendix III.

Experiment to find out if rapid fermentation produces heavier coffee.

It is claimed by many people that when the fermentation of coffee proceeds very quickly the resulting parchment is heavier than that produced when the fermentation proceeds slowly. In order to find out if this observation is correct an experiment was started in December 1952 (9-12-1952). The treatments were:

a) Benefax 1/80% by weight of wet parchment

b) Control (no treatment)

The treatments were replicated four times.

A composite sample of thirty two struck measured seers of wet parchment was drawn from the bulk wet parchment produced on 9–12–1952. After draining the excess water and removing skins, unpulped fruits and gundloos, the parchment was divided into eight equal lots out of which four were chosen at random and treated with Benefax (1/80% by weight on the weight of the raw parchment) after recording the initial weights. The weights of the remaining four were recorded. All the samples were washed as and when they were ready to remove all the adhering mucilage, dried free of surface moisture, and weighed. They were then dried in the sun to constant weight which was recorded.

On being examined statistically, the analysis of covariance revealed that the adjusted mean weight of treatment B is significantly higher than that of treatment A, after washing and drying. When the parchment is weighed to a constant weight however the adjusted mean weight of treatment B declined below that for treatment A, but the excess in weight of treatment A over treatment B does not appear to be statistically significant.

It was, therefore, considered necessary to repeat the experiments in the current year with more replications than those undertaken during the year under report.

Experiments with Robusta Coffee.

Experiments were conducted as in the earlier years to find out the feasibility of preparing parchment with robusta coffee. The objects of preparing parchment or washed coffee are (1) the resultant coffee is much finer in quality than that produced by drying in the skin (2) the drying space and time required for drying parchment coffee is considerably smaller than that required by the cherry or drying in the skin process.

Encouraged by the indication obtained with arabica using *Benefax* and the pectinase prepared by the National Chemical Laboratories, Poona, experiments were conducted with those enzyme preparations, and using wood ashes, as reported in an earlier communication.

Laboratory trials.

From the day's pick of robusta cherry, the unripe ones were separated and the ripe fruits pulped. The skins, unpulped fruits and 'goondloos' accompanying the parchment were hand picked, the parchment given a wash with water and drained. Four struck seers of raw parchment were measured out (weighing approximately 400 gms. each) for each treatment and put into baskets. Six treatments were given using Benefax and N.C.L. Pectinase. The results of the experiments are summarized below and the data pertaining to the temperature and pH readings taken are given in Appendix IV.

Sl. No.	TREATMENT	Time of starting	Time of washing	Total time taken for fermentation
1	Benefax @ 1/40% on the weight of the raw parchment.	5-1-53 4 p.m.	6-1-53 2 p.m.	22 Hours
2	„ 1/80% „	5-1-53 4·10 p.m.	6-1-53 9-10 p.m.	29 „
3	N.C.L. Pectinase @ 1/40% on the weight of the raw parchment.	5-1-53 4-20 p.m.	6-1-53 6-20 p.m.	26 „
4	„ 1/80% „	5-1-53 4-30 p.m.	6-1-53 7-30 p.m.	27 „
5	Wood ashes @ 6 ozs. per bushel (imperial struck)	5-1-53 4-40 p.m.	7-1-53 5-20 p.m.	48 „ 40 Mts.
6	Control	5-1-53 4 p.m.	7-1-53 8 a.m.	40 Hours

The mucilage in the case of wood ashes was found to have hardened and got stuck on the parchment surface. Although the parchment was nonslimy, it was not possible to wash it clean as in the case of the other treatments.

Field Trials:

(*a*) Two sets of field trials using Benefax for fermenting pulped robusta were carried out. In the first set only Benefax was compared with control (no treatment). In the second set Benefax was compared with wood ashes applied to raw parchment kept under water. A control under no treatment was also run.

1st set. 12½ bushels of fruits were pulped and the wet parchment given a preliminary wash and drained. Two bushels of unfermented raw parchment were drawn from it and 17 gms. of Benefax (1/40% on the weight of wet parchment *i.e.* 150 lb. of wet parchment) were mixed thoroughly with it, heaped and left covered with gunny sacks. The balance of 5 bushels and 16 seers of raw parchment was left heaped and covered with gunny sacks. The temperature of the two heaps was taken periodically. The results of the experiment are summarized below—

Sl. No.	Treatment	Time of starting	Time of washing	Total time taken for fermentation
1	1/40% Benefax	21-1-1953 9 p.m.	23-1-1953 4 p.m.	43 hours
2	Control	21-1-1953 9-05 p.m.	27-1-1953 9-30 a.m.	132 hours

Thus with Benefax (1/40% by weight of raw parchment) the parchment washed 88 hours earlier than the control.

2nd set. Eight bushels of ripe robusta fruits were pulped and the raw parchment given a preliminary wash and drained. Three lots each of one bushel and 19 seers of raw parchment were measured out. To the first of these, 14·28 gms. of Benefax (1/40% on the weight of wet parchment)

was added and thoroughly mixed, heaped and covered with gunny sacks in a corner of the vat. The second lot was put in a barrel and water added enough to cover the parchment. 10 oz. of sieved wood ashes (@ 6 oz. by weight per bushel of raw parchment) were added to this parchment in the barrel and well stirred. The third lot was left heaped in the vat and covered with gunny sacks. The results of the experiment are summarized below—

Sl. No.	Treatment	Time of starting	Time of washing	Time taken for washing
1	1/40% Benefax	22-1-1953, 8-15 p.m.	25-1-1953, 4 p.m.	67 hrs. & 45 min.
2	Woodashes	,, 8-20 p.m.	29-1-1953, 4 p.m.	163 ,, 40 ,,
3	Control	,, 8-25 p.m.	29-1-1953, 10 a.m.	157 ,, 35 ,,

Thus with Benefax (1/40% by weight of raw parchment) the parchment washed 91 hours earlier than the control. It is interesting to note that contrary to earlier observations, the treatment with woodashes has not accelerated the fermentation of robusta coffee and actually delayed washing by 6 hours. It may be observed that during this year on account of the drought, the fruits appeared to be less juicy than in previous seasons and mucilage was very sticky like gum.

(*b*) Two trials on private estates were carried out using the 'Guatemala' method of freeing mucilage from raw parchment.

I. **Trial at Urvinkhan Estate:** Two Imperial struck bushels of robusta fruits were pulped and 30 seers of parchment weighing 75 lb. were obtained. A 50 lb. lot was put in a barrel at 3 p.m., half a pound of sieved wood ashes was added immediately followed by one gallon of water. The mass was thoroughly mixed and agitated with a stout stick. After vigorosly stirring for two minutes, a suspension of $\frac{1}{4}$ lb. of hydrated shell lime (sieved to remove lumps, stones, and uncalcined lime) in a small volume of water was added and the agitation continued. Definite signs of reaction could be observed and the mass went on thickening necessitating periodical additions of water (approximately one gallon was added). Samples tested from time to time indicated that the mucilage was being rapidly released from the parchment. The parchment was washed clean at the end of half an hour after starting. The remaining quantity of raw parchment was retained as control, heaped, covered with gunny sacks and allowed to ferment in the usual way.

II. **Trial at Murkull Estate:** A trial similar to the above was carried out at Murkull estate. The treated parchment was ready for washing at the end of twenty minutes after starting.

The observations made are tabulated below:—

	Urvinkhan Estate.	*Murkull Estate.*
Quantity of fruits taken.	2 Imp. Struck bushels.	2 Imp. Struck bushels.
Quantity of raw parchment obtained.	30 seers (75 lb).	31 seers (78 lb.)
Quantity of raw parchment used for experiment.	50 lb.	50 lb.
Time of starting.	3 p.m. on 30–1–53.	2 p.m. on 31–1–53.
Initial temperature.	20°C.	20·5°C.
Initial pH.	7·0.	7·0.
Temperature after adding ash.	20·0°C.	20·5°C.
pH „	above 9.	above 9.
Temperature after adding lime.	20·0°C.	20·5°C.
pH „	above 9.	above 9.
Time at which parchment washed.	3-30 p.m.	2-20 p.m.
Temperature at washing.	20·0°C.	20·5°C.
pH at washing.	above 9.	above 9
Time taken for parchment to be ready for washing.	30 minutes.	20 minutes.
Time taken for Control to be ready for washing.	67 hours.	66½ hours.

This method holds out great promise and will be tried out again with larger quantities of arabica and robusta coffee during 1953–54 harvest.

Trials with leaf injection technique: In the month of March some leaves of certain hybrid plants (Devamachi) developed whitish patches. In some of the patches the veins were still light green and in others were almost white. This suggested that the plants may be suffering from nutritional deficiency. Roach's method of diagnosing the deficiency by injecting nutrients into the leaf was tried. Dilute solutions of N, NP, NK, NPK, P, K and Mg were used at concentrations fixed by Shive. Two leaves were used for each test. The leaf spot was incised with a sharp razor blade and into the slit one end of a filter paper wick was inserted while the other end dipped in a small tube containing the nutrient solution. Though there was a slight noticeable change in colour - veins becoming green and the space between the veins turning slightly greener, in the case of Mg, NP, NK and doubtful in the case of PK and NPK – no conclusions could be drawn. Swabbing the back of the leaves with the solutions was also tried but without any success. The experiment is being repeated.

C. Laboratory:

Work in the laboratory consisted mainly of analysis of soil, plant and manure samples sent by planters and those collected by the department. Analysis of the leaves collected every month from January 1952 onwards from the New Manurial Series was completed. A rapid colorimetric method for the estimation of total phosphorus in soils was standardised. A very interesting soil profile showing pan formations in coffee soils was studied in the field and monolith from the spot was collected for further detailed study in the laboratory.

Analysis of coffee leaves from Manurial Experiments:

In order to find out the nutritional requirement of the coffee plant and its response to fertilizer applications, foliar analysis of samples, collected from the plants in the 'New Manurial Series' was conducted.

(i) *Method of collection and preparation of leaf sample for analysis:* On the 29th or 30th of each calendar month commencing with January 1952 leaves were collected from all the coffee plants in each sub-plot in the New Manurial Series experiments. One branch was chosen at random in each plant in the sub-plots and one leaf out of the first pair of mature leaves from the apex of the branch was collected. The petioles of the leaves were separated and bulked separately and dried. The leaves of each sub-plot were bulked, washed once in distilled water in the laboratory and dried at 80°–100°C until they were crisp enough to be ground to pass through a 40 mesh sieve. The samples thus obtained were kept in aluminium containers until required for analysis. Before analysis the samples were all dried in the hot air oven at 105°C for 5 hours and cooled in a desiccator. Two gms. of the sample were used for determining P. K. and Ca, 0·5 gms. for total N, and 0·1 gm for carbon. For P. K. and Ca, the leaf sample contained in a silica dish was moistened with 8 ml of a 40% Magnesium acetate solution, evaporated on a water bath, ignited on the flame to char the mass, and finally ashed in a muffle furnace at 300°–400°C. The ash was taken up in dil. HCl warmed on the water bath, filtered into a 100 ml standard volumetric flask and the residue on the filter paper washed three to four times, the washing being collected in the flask. The filter paper was ashed in the same silica dish taken up again with dil HCl, filtered, washed and the solution in the standard flask made up to volume. The total N in the 0·5 gm. sample was determined by the usual Kjeldahl method using selenium and copper sulphate as catalysts. The carbon was determined by the wet digestion method of Walkley and Black using diphenyl amine as indicator. Phosphorus was determined by the colorimetric method recommended by A.O.A.C., potassium by the platinic chloride method and Ca volumetrically after precipitation as oxalate and titration with permanganate.

A second cycle of analysis is in progress and results will then be discussed.

Standardization of rapid colorimetric method for the estimation of total P_2O_5 in soils.

The conventional methods of soil analysis utilize the hydrochloric acid extract for the determination of total phosphorus in soils. The methods given in standard reference books are either gravimetric or volumetric in which the phosphorus is precipitated as the yellow phosphomolybdate under specified conditions. It is well known that the composition of this precipitate is not constant unless the precipitation is

carried out under very carefully controlled conditions. The many steps involved take a good deal of time and increase the possibility of error. Analysts have been on the look out for a simple and accurate method for the determination of total phosphorus in soils. The application of colorimetry opened up a new avenue for the approach to this problem. Ever since 1920 various analysts developed colorimetric methods employing the molybdenum blue obtained by reduction. Many reducing agents were tried and a very good summary of these attempts is given in "Colorimetric methods of analysis" by Snell and Snell. The greatest difficulty experienced has been the instability of the colour due to interference of other ions present in soils, particularly iron.

The soils on which coffee is grown in South India contain appreciable amounts of iron which interfere in the development of the molybdenum blue colour.

Mildred S. Sherman described a method in which the soil is digested with 60% Perchloric acid and the phosphate contained in the perchloric acid extract determined colorimetrically using 1–2–4 amino naphthol sulphonic acid as reducing agent. While this method is rapid and accurate, it is expensive as the quantity of 60% perchloric acid to be employed for each determination is high. Further the extract cannot be used for the determination of potash which doubles the work when the total P & K of a large number of samples are to be determined in a relatively short time.

O. Hoffman has pointed out that at higher acid concentrations increasing the anion, such as chloride ion, does not have a great effect on the results. Therefore, it was considered that it should be possible to use the hydrochloric extract and determine the phosphorus directly in the presence of small quantities of perchloric acid using 1–2–4 amino naphthol sulphonic acid as reducing agent. This reducing agent is less sensitive to interfering ions especially ferric ion, than stannous chloride.

The following modification of the Sherman method is simple, direct and accurate and has been successfully used in the laboratories of this Research Station.

The soil samples (usually 5 g air dry sample) are digested with (50 ml) constant B. P. Hydrochloric acid for one hour (A. E. A. – 1951 Provisional method. Piper C.S – Soil and Plant Analysis '44), cooled and made up to volume (200 ml). A suitable aliquot depending on the P_2O_5 content of the soil (usually 2 ml) is taken in a 25 ml standard flask, 2·5 ml of 60% perchloric acid added after diluting to 15 ml, followed by 0·8 ml of 1–2–4 amino naphthol sulphonic acid reagent (prepared as given by Sherman) and 2 ml of a 5% solution of ammonium molybdate, made up to volume, allowed to stand for 15 minutes and the deflection read

off on a colorimeter (EEL portable colorimeter is used in this laboratory) using a red filter. The P_2O_5 values are read off on a graph previously prepared in which varying quantities of standard K_2HPO_4 are plotted against the deflections obtained. Practically a straight line graph can be obtained if great care is taken in preparing it.

The following table gives the results obtained with a few samples of soils.

Sl. No.	Soil samples		% P_2O_5 HCl extract (Volumetric method)	% P_2O_5 (Perchloric acid Extract Colorimetric)	% P_2O_5 (HCl Extract plus Perchloric acid) colorimetric
1	Kolarkhan Soil	No. A	0·150	0·151	0·153
2	,, ,,	No. B	0·175	0·169	0·161
3	,, ,,	No. C	0·197	0·205	0·200
4	,, ,,	No. D	0·084	0·082	0·081
5	Emmekhan Soil	No. A	0·096	0·097	0·105
6	,, ,,	No. B	0·197	0·178	0·199
7	,, ,,	No. C	0·322	0·308	0·318
8	,, ,,	No. D	0·110	0·108	0·106
9	,, ,,	No. E	0·092	0·085	0·083
10	,, ,,	No. F	0·119	0·109	0·107
11	Kummergode Soil	No. A	0·234	0·212	0·230
12	,, ,,	No. B	0·147	0·146	0·144
13	,, ,,	No. C	0·173	0·171	0·171
14	,, ,,	No. D	0·111	0·092	0·106
15	,, ,,	No. E	0·176	0·172	0·167

It will be seen from the above that good agreeing values can be obtained using the colorimetric method. The error was found to be not significant when the data was analysed by the calculation of the standard deviation of intercept in statistics of the straight line (W. J. Youden Statistical methods for Chemists pp. 41–45). In the volumetric method silica is also coprecipitated sometimes and leads to higher values. The colorimetric method does not have this drawback.

When a soil is extracted with hydrochloric acid in the manner described above and made up to volume the final solution was found to be approximately 2N with respect to HCl.

The effect of varying quantities of hydrochloric acid present in the final volume at the time of development of colour was studied, using standard K_2HPO_4 solution and hydrochloric acid. It was found that up to 2·5 times the concentration of hydrochloric acid present in a usual soil – HCl extract at the time of development of colour, the chloride ion has no effect and values agree closely. Above this concentration development of colour is slow. The colour is stable up to 45 minutes which gives a good latitude for work.

In a study similar to the above but using perchloric acid extracts of soils with added hydrochloric acid in concentrations calculated to give 2 to 3 times that present in the final volume at time of development of colour as in the previous study, the results obtained were the same as that of the above experiment.

The optimum quantity of perchloric acid which should be present in the final volume at development of colour has been found to be 2·5 to 4 ml of 60% Perchloric acid (Sherman). This has also been confirmed in the trials conducted here.

Conclusions:

(1) It is, therefore, possible to use the usual hydrochloric acid extract for determining the total P_2O_5 content of soils by adding 2·5 ml of 60% Perchloric acid for a final volume of 25 ml at the time of developing of colour with 1–2–4 amino naphthol sulphonic acid and ammonium molybdate. The HCl extract can be used for determining K_2O etc., thus saving on time and expenditure

(2) When using an HCl extract with added perchloric acid the colour developed is constant up to 45 minutes after which the intensity increases.

(3) There is no effect of chloride ions up to a concentration of HCl which is 2½ times the concentration present in a usual HCl extract of soils at the time of development of colour (2 ml soil extract plus 2·5 ml 60% perchloric acid plus 0·8 ml 1–2–4 amino naphthol sulphonic acid reagent plus 2·0 ml ammonium molybdate made up to 25 ml.).

Standardization of a Colorimetric method for the estimation of Potassium.

The method in which potassium is precipitated as K_2PtCl_6 filtered, washed, dissolved in hot water, reduced with stannous chloride and the resulting orange yellow colour compared with colour developed from standards was tested out. The method did not prove successful as the other salts that are insoluble in 80% alcohol and get precipitated with Potassium Platinic chloride cause a turbidity when dissolved in hot water and give erroneous values. Further the recovery of Platinum from the solution becomes very laborious and difficult. Therefore, other methods for determining Potash are being explored.

Soil Analysis.

Over 100 soil samples from ten estates lying in different zones were collected for one purpose or another and examined for their chemical content and their physical condition. The results are under examination for correlation of crop production and nutritional requirement.

The number of determinations carried out during the year were as follows:—

Moisture	–	468
Loss on Ignition	–	54
Total Nitrogen	–	753
Total P_2O_5	–	746
Total K_2O	–	743
Total CaO	–	280
Total MgO	–	3
Insoluble residue	–	62
pH	–	133
Lime requirement	–	110
Carbon	–	283
Available P_2O_5	–	60
Available K_2O	–	60
Mechanical analysis	–	124
Clay analysis	–	18
Total copper	–	5
Free CaO in lime	–	1
Fe_2O_3	–	14
	Total	3917

A paper on 'Green manures' was published in the Indian Coffee Board Bulletin – "Indian Coffee".

A paper on the "Estimation of Phosphorus in soils by 'Colorimetry'" was prepared and sent to the 'Current Science' for publication.

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III A. AGRONOMY

The following experiments were conducted during the year. The Plant Pathology experiments were conducted on a coordinated basis by both Agronomy and Entomology Assistants:—

Trials in Agronomy Practices experiment, Coffee Research Station, Balehonnur

Mulching experiment, Coffee Research Station, Balehonnur

Robusta Manuring experiment, Coffee Research Station, Balehonnur

Robusta Manuring and Pruning experiment, Devadhanam Estate

Robusta Manuring and Pruning experiment, Bhadra Estate

Robusta Topping experiment, Byregudda Estate

Robusta Topping experiment, Murkull Estate

Blossom-berry observations, Coffee Research Station, Balehonnur

Rooting of sucker cuttings.

(1) Trials in Agronomy Practices:

This experiment was started in 1951 to try, on a replicated basis, the cultural treatments that have already been tried on a non-replicated basis. The treatments embody all possible combination of time and depth of cultivation in practice, mulching, weeding, pruning, different times and types of manuring etc.

The object of the experiment is to find out a suitable combination of different agronomic practices for getting increased yields in coffee under varying ecological conditions of shade, depth of soil and fertility.

The plot yields were taken in November–December 1951 to standardise them and no significant difference between plots during the pre-treatment period was noticed.

Locality: Balehonnur. *Year:* 1952–53.
Lay-out: Randomised block. *Variety:* Coorg.
Replications: 4. *Treatments:* 14.

Plot size

I, II and III replication	gross	18 × 8 = 144 plants = 8·3 cents.
	nett	13 × 6 = 78 plants = 4·48 cents.
IV replication	gross	15 × 8 = 120 plants = 6·88 cents.
	nett	13 × 6 = 78 plants = 4·48 cents.

Details of the treatments are furnished in Table AII.

TABLE A–I: YIELD DATA OF AGRONOMY EXPERIMENT AT BALEHONNUR

Sl. No.	Symbol	Yield of ripe cherry in lb. per acre	Calculated clean coffee in cwt./acre
1	A	649	4·41
2	B	570	4·43
3	C	486	3·80
4	D	493	3·39
5	E	510	3·80
6	F	384	2·62
7	G	358	2·77
8	H	486	3·34
9	I	460	3·47
10	J	367	2·25
11	K	298	2·46
12	L	398	2·79
13	M	500	3·52
14	N	341	2·47
	General Mean	450	3·26
	Significant or not	Yes	
	Critical difference	122·4	
	Standard error (expressed as % of general mean)	13·31	
	Conclusions: A B E M D C H I L F J G N K		

The first year's result is significant. Treatment A and B indicate their superiority over the rest of the treatments. This experiment is a long range one and has to be continued for ten or more years.

TABLE A–II: DETAILS OF TREATMENTS IN AGRONOMY EXPERIMENT, BALEHONNUR

Treatments	January	February	March	April	May	June	July	August	September	October	November	December	Remarks
A	—	—	—	—	—	—	SW	DD	M	SS		—	
B	—	M Pre-blossom		—	—	—	SW	DD	—	SS		—	
C	—	—	—	M Post-blossom		—	SW	DD	—	SS		—	SW: Slash Weeding
D	—	—	—	—	—	—	SW	—	M Kdag		—	—	CW: Clean Weeding
E	—	—	—	M Post-blossom		—	SW	—	Kdag		—	—	M: Manuring (40–30–40)
F	—	—	—	—	—	—	CW	—	M CW		—	CW	ML: Mulching
G	—	—	—	M Pre-monsoon		—	CW	—	CW		—	CW	MF: Mamooty Forking
H	—	S S M		—	—	—	CW	—	—	—	—	—	DD: Deep Digging
I	—	—	—	M (20–30–40) Pre-monsoon		—	SW	—	M (20n only) Kdag		—	—	Kdag: Kadagathe PR: Pruning
J	—	PR	—	—	—	—	SW	DD	M	SS		—	SS: Soil stirring
K	—	PR	—	—	—	—	SW	—	M Kdag		—	—	
L	—	M		—	—	—	—	—	—	—	—	D (MF) ML	
M	—	M (30N only) $(NH_4)_2 SO_4$		—	—	—	—	—	M (30N only) $(NH_4)_2 SO_4$		—	—	
N	—	M (30N only) $(NaNO_3)$		—	—	—	—	—	M (30N only) $(NaNO_3)$		—	—	

(2) Mulching Experiment

This experiment was started in the 17-acre block on two-year old coffee in 1951 on the lines of trials conducted at Moshi, South Africa. This experiment was laid out to study the benefits of applying banana trash mulch and leaf mulch and comparing them with *Crotalaria anagyroides* grown 'in situ' and mulched, and no mulch.

Length of the longest primary was first noted in November, 1952, when the growth was the least, and again in July, 1953, when the active growth period had been completed. This data was collected from the central two rows of plants from each plot. The average extension of growth per unit length of each of the branches was calculated and the data analysed.

Locality: Balehonnur
Lay-out: Latin square
Replication: 4
Treatments: 4
Year: 1952–53
Plot size:
gross: 6×4 = 24 plants = 2·00 cents
nett: 4×2 = 8 plants = 0·66 cents

Total area under the experiment: 0·32 acres.

TABLE A–III: RESULT OF MULCHING EXPERIMENT

Sl. No.	Symbol	Treatment	Average increase in length per plant per branch	
			1951-52	1952-53
1	A	Banana trash @ 40 lb./plant	0·42 cm.	5·846 cm.
2	B	Leaf mulch @ 40 lb./plant	0·39 cm.	2·984 cm.
3	C	Control (no mulch)	0·39 cm.	1·650 cm.
4	D	*Crotalaria anagyroides* grown 'in situ' and mulched	0·33 cm.	3·350 cm.
		Mean	0·38 cm.	3·458 cm.
		Significant or not	No	No
		Critical difference	0·13	0·98
		S.E.M. %	9·97	11·63
		Conclusions	All equal	A $\overline{D\ B}$ C

The result does not show any significant difference between the various treatments but numerically the treatment with banana trash made better growth than all other treatments.

(3) Robusta Manurial trials

This experiment was started in 1951, near the Pulper house, to find out the result of applying complete manures with two variants of two levels of nitrogen. Half the dose of nitrogen was applied as a pre-blossom treatment and the rest, along with phosphoric acid and potash, during post-monsoon.

Locality : Balehonnur *Year :* 1952–53
Lay-out : Randomized
Replications : 6 *Treatments :* 3
Plot size : gross :– 4×8 = 32 plants = 4·7 cents
nett :– 2×6 = 12 plants = 1·8 cents
Total area under the experiment : 0·85 acres

Replication II, IV and VI were given light pruning before blossom to study the interaction between pruning and manuring.

TABLE A–IV : RESULT OF ROBUSTA MANURIAL EXPERIMENT AT BALEHONNUR

Sl. No.	Symbol	Treatment	Yield of cherry in lb./sare	Calculated clean coffee in cwt/acre	% of float by weight
1	A	N.P.K. @ 40–30–40 lb/acre	2427	10·21	3·17
2	B	N.P.K. @ 80–30–40 lb per acre	2172	8·57	4·30
3	C	Control–no manure	2333	9·07	3·79
		General mean	2310·7	9·28	
		Significant or not	YES		
		Critical difference	221		
		S.E.M. %	4·293		
		Conclusions	A C B		

Treatment A gave significantly higher yield than the rest. Surprisingly, control plots have given a higher yield than the plots manured with the double dose of nitrogen.

(4 and 5) **Robusta Manurial and Pruning Experiments at Bhadra and Devadhanam Estates.**

On the suggestion of the Research Committee, two identical experiments were started at Bhadra and Devadhanam Estates, Balehonnur, during 1952. The objects of the experiments are to study the interaction of pruning and manuring at two different levels of nitrogen and comparing them with the check plots with regard to both pruning and manuring. The details of the various treatments are given in Table A. V and A. VI.

Half the nitrogen was applied during pre-blossom and the other half along with the phosphoric acid and potash during the post-monsoon. Bonemeal and muriate of potash were applied in six-inch deep trenches running between every two rows of coffee, whereas ammonium sulphate was broadcast uniformly around each plant, outside the drip-circle. In treatments to be pruned, light pruning was given pre-blossom.

Lay-out and size of the plots are identical in both the estates:

Localities : Bhadra and Devadhanam Estates, Balehonnur.
Year : 1952–53 *Lay-out :* Latin square *Replications :* 6
Treatments : 6 *Plot size :* gross :– 6x10 = 60 plants = 8·8 cents
nett :– 4x8 = 32 plants = 4·7 cents
Total area under the experiment : 3·17 acres in each estate.

TABLE A–V: RESULTS OF THE BHADRA ROBUSTA MANURIAL AND PRUNING EXPERIMENT

Sl. No.	Symbol	Treatment	Yield of ripe cherry in lb. per acre	Yield of clean coffee (calculated) in cwt/ acre	% float by weight
1	A	Control–no manure	3836	6·80	3·30
2	B	Pruned–no manure	3586	6·31	3·02
3	C	N.P.K. @ 40–30–40 lb/acre	3707	6·48	3·96
4	D	N.P.K. @ 80–30–40 lb/acre	4038	7·10	3·43
5	E	N.P.K. @ 40–30–40 lb/acre & pruned	4265	7·49	3·65
6	F	N.P.K. @ 80–30–40 lb/acre & pruned	3925	6·79	3·69
		General mean :	3892·8	6·81	
		Significant or not :	Yes		
		Critical difference :	624·7		
		S.E.M. % :	9·67		
		Conclusions :	E D F A C B		

TABLE A–VI: DEVADANAM ROBUSTA MANURIAL AND PRUNING EXPERIMENT

Sl. No.	Symbol	Treatment	Yield of ripe cherry in lb. per acre	Calculated yield of clean coffee in cwt. per acre	% float by weight
1	A	Control - no manure	5428	9·27	3·79
2	B	Pruned but no manure	5983	8·93	4·19
3	C	N.P.K. @ 40–30–40 lb. per acre	5817	8·50	4·30
4	D	N.P.K. @ 80–30–40 lb. per acre	5688	9·82	3·17
5	E	N.P.K. @ 40–30–40 lb. per acre and pruned	6545	11·52	4·11
6	F	N.P.K. @ 80–30–40 lb. per acre and pruned	6040	10·79	3·13
		General mean:	5916·9	10·31	
		Significant or not:	Yes		
		Critical difference:	374·5		
		S. E. M. %:	3·03		
		Conclusions:		E F B C D A	

Both the experiments gave significant results. Manuring at the rate of 40–30–40 lb. per acre of N.P.K. followed by a medium pruning during the pre-blossom gave the highest yield in both the estates. Manuring at the rate of 80–30–40 of N.P.K. (Treatment D) and manuring at the rate of 80–30–40 followed by medium pruning (Treatment F) came next in Bhadra whereas, Treatment F followed the Treatment E in Devadanam Estate.

(6 and 7) **Robusta Topping Experiments at Byregudda and Murkull Estates.**

These experiments were started in 1951 at Byregudda and in 1952 at Murkull. The plots were laid out in the ABBA pattern with 12 replications.

The planting distance in the former is 9′x9′ and 8′x8′ in the latter; the age of the plants being 3 and 4 years respectively.

The object of the experiments is to study the growth and yield of Robusta coffee under two different topping heights of 3 feet and 4 feet. The yield will be recorded when the plants come to bearing. At present, growth measures were recorded, once in November, 1952, and again in August, 1953, and the average extension of growth per unit length of each of the branches was calculated and analyzed.

Localities: Byregudda and Murkull estates
Year: 1952–53
Lay-out: ABBA
Replications: 12
Plot size: 4x8 = 32 plants = 5·95 cents – Byregudda
= 4·70 cents – Murkull
Total area under the experiment: 1·43 acres (Byregudda)
1·11 acres (Murkull)

TABLE A–VII: ROBUSTA TOPPING EXPERIMENT, BYREGUDDA

Sl. No.	Symbol	Treatment	Average increase in length per plant per branch
1	A	Plants topped @ 3 feet height	1·27 cm.
2	B	Plants topped @ 4 feet height	1·18 cm.
		Mean:	1·28 cm.
		Significant or not:	Basic measurements. Difference between the two treatments is present.
		Conclusions:	A B.

TABLE A–VIII: ROBUSTA TOPPING EXPERIMENT, MURKULL

Sl No.	Symbol	Treatment	Average increase in length per plant per branch
1	A	Plants topped @ 3 feet height	1·51 cm.
2	B	Plants topped @ 4 feet height	1·48 cm.
		Mean:	1·50 cm.
		Significant or not:	Basic measurements. Difference between the two treatments is not significant.
		Conclusions:	$\overline{A\ B}$

(8) Observational studies on Blossom-Berry correlations.

Two sets of blossom-berry observations were started during the year. One was started in December, 1952, when less than 1% of blossoms opened out incipiently after 1·31 inches of rain was received. The second observation was started after the regular blossom showers were received in

April. Both these sets of observations will be continued till the ripening of the berries.

(a) *December blossom berry observations.*

This observation was started on eight plants selected at random in the estate to study the effect of the climate on the setting of blossoms and development that have come out too soon. Ten branches from each of these eight plants were tagged, the number of blossoms opened out counted and the number of berries retained on these branches noted every month. The percentage of berry retention in each case was calculated.

TABLE A–IX : DECEMBER BLOSSOM–BERRY OBSERVATIONS

No. of the plant	Percentage of berries retained per plant (mean of ten branches per plant) during the month of					
	January 1953	February 1953	March 1953	April 1953	May 1953	June 1953
1	98·14	95·76	82·88	81·94	48·97	48·24
2	99·07	93·80	73·41	51·08	41·57	40·87
3	97·81	96·10	86·33	78·84	76·00	72·69
4	92·38	88·73	73·12	59·78	51·72	51·33
5	83·54	72·65	43·05	20·19	19·24	18·65
6	88·88	83·87	69·99	68·59	63·59	62·97
7	95·01	89·31	82·56	65·60	65·19	65·19
8	94·60	92·33	70·09	63·48	63·48	44·22
Mean :	93·68	89·12	72·68	60·56	58·72	50·52

The prolonged drought conditions during February, March and April 1953 reflected in the steep fall in the percentage of retention of berries recorded during March and April (*viz.* 16·44% and 12·22% respectively). Later on, due to the receipt of the blossom showers and the backing rains, the fall in the percentages became less.

(b) *April Blossom-Berry Observations.*

This observation was started after the regular blossom showers were received in April. Twelve Kents arabica plants were selected and tagged. As soon as the blossoms opened out, two types of branches were selected from each of these plants and labelled. They were:—

(*i*) branches with all leaves present and

(*ii*) branches with less leaves in the same number of nodes.

The number of flowers in each of the nodes in both the types of branches were noted. Thereafter, every month the berries peresent in the same branches were counted and the percentages of retention calculated. Thus, in this observation, comparison between two types of branches is made–those with all the leaves and those with less leaves in the same number of nodes. The presence or absence of the leaves on the branches and their reflection on the bearing of the crop is the object of the observation.

TABLE A–X : APRIL BLOSSOM-BERRY, OBSERVATIONS

Plant No.	Branches with *All* leaves		Branches with *Less* leaves	
	% berries retained during the months of		% berries retained during the months of	
	May, 1953	June, 1953	May, 1953	June, 1953
1	92·9	87·3	71·1	44·2
2	86·9	79·8	92·1	81·6
3	94·2	31·9	62·7	40·1
4	83·1	60·7	64·5	6·5
5	90·7	86·2	96·3	62·9
6	87·2	58·2	61·0	16·9
7	98·3	98·3	85·0	77·5
8	95·4	81·8	92·4	84·9
9	97·4	93·1	97·3	97·3
10	97·4	97·4	62·1	58·1
11	96·3	92·5	98·9	93·4
12	94·2	94·2	86·3	82·1
Mean	92·8	80·1	80·8	62·1

The above data indicate that the branches having all leaves retain more berries than the branches with less leaves. The fall in percentages of retention recorded from May to June is 12·7% in branches having all the leaves as against 18·7% in branches with less leaves, the latter showing lesser ability to retain more crop than the former.

(9) **Vegetative Propagation – Rooting of coffee sucker cuttings.**

As a complement to the experiment conducted during the previous year, this experiment was started in November, 1952. The former experiment dealt with a different season (it was started in July 1951) when the moisture content of the atmosphere was very high, thus helping to a certain extent the easy rooting of the cuttings. The season during which this experiment was laid out is markedly drier with less amount of water content in the atmosphere.

Three different types of treatments were laid out. a–Naphthaleneacetic acid, b–Indolylbutyric acid, b–Indolylacetic acid, and 2,4,–Dichlorophenoxyacetic acid are compared with cow's urine extract and no treatment. These treatments were laid out as two separate categories – 12–hour treatment and 24–hour treatment. The third set was :— Belvitan paste, Belvitan powder, Seradix A, Seradix B_1, Seradix B_2, and Seradix B_3 compared with cow's urine extract and no treatment. These were treated for 24 hours.

Four different types of cuttings were employed. They were – 1st internode, 2nd internode, 3rd internode and 4th internode. That is, four–noded suckers were selected from leaf disease susceptible coffee in the estate and the different internodes required for the experiment cut out

from them and numbered. The required solutions of the various growth promoting substances were then made in tap–water and the basal ends of the suckers kept immersed in the solutions for the required periods. Immediately afterwards, they were planted out in the Propagation chambers. A thin moss covering of the sand was done to minimise water evaporation. The chambers were watered twice daily and were given cloth covering at the top during the hot parts of the day. Regular examination of the cuttings for any root formation was carried out. During March, 1953, these cuttings were all removed from the chambers and observations recorded (given in Tables A–XI and XII.).

The treatments where cuttings were immersed in the growth–promoting substances for 12 hours gave better percent of survival and rooting than those treated for 24 hours. The last set of cuttings treated with Seradix products and Belvitan products fared worse. Scorching effect was noticed in the cases of 2–4–D treatments, more so in the 100 p.p.m. concentration. Urine extract seemed to be as good as b–Indolylbutyric acid or the a–Naphthaleneacetic and b–Indolylbutyric acids mixture. a–Naphthaleneacetic acid at 100 p.p.m. and 200 p.p.m. concentration was also good.

Tables A–XI and A–XII (pages 55 to 58) summarises the results of the experiments.

TABLE A–XI: ROOTING OF SUCKER CUTTINGS EXPERIMENT, 1952–53

Sl. No.	Treatment	Strength used	Internode	12—HOUR TREATMENT Planted on 4-11-52. Removed on 24-3-53					24—HOUR TREATMENT Planted on 5-11-52. Removed on 27-3-53				
				Living %	Rooted %	Average No. of main roots	Average length of main roots	Average No. of Branch roots	Living %	Rooted %	Average No. of main roots	Average length of main roots	Average No. of Branch roots
1	a–Naphthaleneacetic acid	25 p.p.m.	I	50·00	37·50	4·00	28·75	92·50	37·50	37·50	3·00	36·27	73·33
	,,	,,	II	37·50	25·00	2·33	16·63	36·33	62·50	50·00	3·80	33·16	40·60
	,,		III	37·50	25·00	2·50	12·95	13·50	Nil	—	—	—	—
	,,	,,	IV	37·50	25·00	4·00	7·30	11·00	12·50	12·50	3·00	15·60	10·00
2	a–Naphthaleneacetic acid	100 p.p.m.	I	75·00	50·00	4·00	37·15	92·50	75·00	62·75	5·25	58·75	141·00
	,,	,,	II	37·50	12·50	3·17	22·28	27·83	75·00	75·22	5·50	41·63	67·50
	,,	,,	III	75·00	62·50	2·67	16·30	36·00	12·50	12·50	1·00	3·50	—
	,,	,,	IV	12·50	12·50	3·50	27·05	65·00	nil	—	—	—	—
3	a–Naphthaleneacetic acid	200 p.p.m.	I	25·00	25·00	6·00	49·83	117·75	37·50	25·00	4·50	32·65	57·00
	,,	,,	II	75·00	75·00	8·00	16·90	—	25·50	C	—	—	—
	,,	,,	III	50·00	37·50	5·40	92·32	11·40	50·00	25·00	7·50	32·90	31·00
	,,	,,	IV	50·00	25·00	4·00	33·00	46·00	12·50	C	—	—	—
4	b–Indolylbutyric acid	25 p.p.m.	I	75·00	25·00	3·00	11·25	33·50	50·00	25·00	4·00	25·50	78·50
	,,	,,	II	75·00	37·50	13·25	8·58	17·50	62·50	25·00	3·00	23·80	60·50
	,,	,,	III	62·50	C	—	—	—	62·50	37·50	3·33	13·17	15·00
	,,	,,	IV	25·00	C	—	—	—	25·00	12·50	1·00	0·50	—
5	b–Indolylbutyric acid	100 p.p.m.	I	37·50	37·50	2·00	16·17	71·33	50·00	37·50	3·67	30·27	74·33
	,,	,,	II	75·00	62·50	1·40	11·58	30·60	25·00	12·50	5·00	43·30	57·00
	,,	,,	III	25·00	12·50	3·00	32·30	92·00	37·50	C	—	—	—
	,,	,,	IV	37·50	25·00	2·00	13·30	48·00	12·50	12·50	4·00	6·90	15·00
6	b–Indolylbutyric acid	200 p.p.m.	I	50·00	37·50	3·33	33·73	74·66	25·00	25·00	3·00	32·20	62·00
	,,	,,	II	37·50	12·50	5·00	2·50	19·68	25·00	C	—	—	—

Table A–XI : (*Continued*)

Sl. No.	Treatment	Strength used	Internode	12—HOUR TREATMENT Planted on 4-11-52. Removed on 24-3-53					24—HOUR TREATMENT Planted on 5-11-52. Removed on 27-3-53				
				Living %	Rooted %	Average No. of main roots	Average length of main roots	Average No. of Branch roots	Living %	Rooted %	Average No. of main roots	Average length of main roots	Average No. of Branch roots
	b–Indolylbutyric acid	200 p.p.m.	III	50·00	50·00	2·50	19·68	63·00	62·50	50·00	4·25	22·30	43·50
	,,	,,	IV	37·50	25·00	2·00	12·05	49·00	25·00	25·00	6·00	41·75	55·00
7	b–Indolylacetic acid	25 p.p.m.	I	50·00	37·50	3·00	28·17	81·00	37·50	12·50	3·00	41·70	130·00
	,,	,,	II	100·00	12·00	1·00	4·60	—	25·00	12·50	7·00	44·00	143·00
	,,	,,	III	75·00	50·00	1·50	11·73	37·50	50·00	25·00	1·15	7·25	36·50
	,,	,,	IV	25·00	12·50	3·00	34·50	99·00	12·50	C	—	—	—
8	b–Indolylacetic acid	100 p.p.m.	I	62·50	25·00	3·00	26·55	78·50	12·50	12·50	2·00	20·50	72·00
	,,	,,	II	100·00	50·00	2·50	28·28	44·25	25·00	25·00	3·00	17·00	10·50
	,,	,,	III	25·00	25·00	4·00	14·90	14·00	25·00	12·50	5·00	55·80	123·00
	,	,,	IV	12·50	12·50	2·00	35·20	91·00	nil	—	—	—	—
9	b–Indolylacetic acid	200 p.p.m.	I	25·00	25·00	2·00	15·00	50·00	12·50	12·50	3·00	20·30	25·00
	,,	,,	II	nil	—	—	—	—	37·50	25·00	5·50	6·65	—
	,,	,,	III	nil	—	—	—	—	37·50	C	—	—	—
	,,	,,	IV	12·50	C	—	—	—	37·50	12·50	3·00	13·20	40·00
10	2–4 Dichloro-phenoxyacetic acid	10 p.p.m.	I	12·50	12·50	1·00	10·10	34·00	nil	—	—	—	—
	,,	,,	II	nil	—	—	—	—	25·00	12·50	3·00	11·30	—
	,,	,,	III	37·50	37·50	4·33	27·30	69·00	37·50	37·50	6·00	30·37	46·38
	,,	,,	IV	12·50	C	—	—	—	25·00	12·50	6·00	28·70	34·00
11	2–4 Dichloro-phenoxyacetic acid	25 p.p.m.	I	37·50	37·50	4·67	50·73	170·00	12·50	12·50	6·00	46·30	96·00
	,,	,,	II	12·50	12·50	5·50	33·90	88·00	25·00	25·00	7·50	22·10	19·50

	,,	,,	III	25·00	12·50	R	—	—	nil	—	—	—	—
	,,	,,	IV	12·50	12·50	—	—	—	12·50	12·50	16·00	67·50	123·00
12	2-4 Dichloro-phenoxyacetic acid	100 p.p.m.	I	nil	—	—	—	—	nil	—	—	—	—
	,,	,,	II	nil	—	—	—	—	nil	—	—	—	—
	,,	,,	III	12·50	12·50	7·00	23·00	7·00	nil	—	—	—	—
	,,	,,	IV	nil	—	—	—	—	nil	—	—	—	—
13	a-Naph. plus b-Indol. butyric acids	200 p.p.m.	I	50·00	25·00	1·50	22·30	54·00	12·50	12·50	7·00	67·60	211·00
	,,	,,	II	50·00	25·00	6·00	43·00	135·50	50·00	50·00	3·25	22·60	45·50
	,,	,,	III	87·50	25·00	4·00	22·10	49·50	nil	—	—	—	—
	,,	,,	IV	12·50	12·50	1·00	9·50	26·00	25·00	25·00	3·00	11·50	18·00
14	Ammonium phosphate	0·5%	I	50·00	25·00	4·50	36·40	147·50	nil	—	—	—	—
	,,	,,	II	12·50	12·50	3·00	22·30	43·00	12·50	12·50	3·00	12·70	—
	,,	,,	III	50·00	12·50	6·00	28·10	51·00	12·50	C	—	—	—
	,,	,,	IV	nil	—	—	—	—	12·50	C	—	—	—
15	Potassium permanganate	0·1%	I	62·50	25·00	2·50	6·75	6·50	37·50	25·00	9·00	54·15	77·50
	,,	,,	II	12·50	C	—	—	—	37·50	25·00	6·00	48·80	102·50
	,,	,,	III	50·00	12·50	3·00	26·30	98·00	25·00	12·50	5·00	24·00	55·00
	,,	,,	IV	50·00	C	—	—	—	37·50	C	—	—	—
16	Cow's Urine extract	2%	I	62·50	12·50	R	—	—	nil	—	—	—	—
	,,	,,	II	52·50	50·00	4·00	27·28	58·00	12·50	C	—	—	—
	,,	,,	III	75·00	25·00	3·00	14·45	61·50	nil	—	—	—	—
	,,	,,	IV	nil	—	—	—	—	12·50	C	—	—	—
17	Control – no treatment	—	I	50·00	—	—	—	—	25·00	12·50	3·00	2·00	—
	,,	—	II	50·00	25·00	1·50	6·35	15·50	37·50	12·50	3·00	8·00	16·00
	,,	—	III	37·50	—	—	—	—	12·50	—	—	—	—
	,,	—	IV	12·50	—	—	—	—	nil	—	—	—	—

Note :—C = Callused
R = Rudimentary roots.

TABLE A–XII: ROOTING OF COFFEE SUCKERS II SET

Treatment	Concentration	Inter-node	% living	% rooted	Average no. of main roots	Average length of main roots	Average no. of Branch roots
Seradix A	higher concentration 1·8%	I	37·50	12·50	4·50	54·95	126·00
	,,	II	62·50	43·75	2·17	21·00	69·67
	,,	III	43·75	12·50	6·00	43·45	88·50
	,,	IV	nil	—	—	—	—
Seradix A	lower concentration 0·9%	I	43·75	25·00	3·00	28·08	67·75
	,,	II	62·50	43·75	5·14	29·46	40·29
	,,	III	50·00	50·00	3·75	59·45	98·00
	,,	IV	nil	—	—	—	—
Seradix B_1	powder	I	25·00	18·75	3·00	27·37	105·00
	,,	II	50·00	6·25	4·00	14·80	—
	,,	III	25·00	12·50	3·20	24·30	60·20
	,,	IV	50·00	25·00	4·40	28·00	39·00
Seradix B_2	powder	I	6·25	6·25	5·00	39·30	43·00
	,,	II	25·00	25·00	4·00	26·10	26·50
	,,	III	25·00	18·75	3·67	25·93	61·67
	,,	IV	12·50	12·50	6·67	36·20	73·33
Seradix B_3	powder	I	nil	—	—	—	—
	,,	II	nil	—	—	—	—
	,,	III	6·25	C	—	—	—
	,,	IV	31·25	31·25	3·00	14·30	72·00
Belvitan paste	—	I	nil	—	—	—	—
		II	92·75	50·00	4·25	24·18	44·25
		III	50·00	6·25	4·00	40·40	138·00
		IV	25·00	6·25	4·00	34·20	82·00
Belvitan powder	—	I	18·75	6·25	8·00	56·50	115·00
		II	43·75	18·75	3·50	28·85	101·00
		III	43·75	12·50	9·00	52·60	151·00
		IV	6·25	6·25	7·00	59·30	147·00
Urine extract	2%	I	—	—	—	—	—
		II	31·25	18·75	4·00	19·25	10·00
		III	18·75	C	—	—	—
		IV	31·25	18·75	3·50	31·35	88·50
Control – no treatment (dipped in water)	—	I	56·25	25·00	3·75	15·90	42·50
		II	91·67	6·25	6·00	38·30	44·00
		III	nil	—	—	—	—
		IV	6·25	C	—	—	—

Note:—C: Callused.

III B. PLANT PROTECTION

Following were the experiments that were conducted during the year under report, both in the Station and elsewhere on private estates.

A. **Pests :—**

(*i*) Stem Borer control Experiments, Coffee Research Station, Balehonnur.

(*ii*) Stem Borer Control Experiments (new), Coffee Research Station, Balehonnur.

(*iii*) Eel-worm Control Experiments, Elamadlu Estate, Koppa-Chikmagalur.

B. **Diseases :—**

(*iv*) Spraying Experiment with copper fungicides and detergents, Coffee Research Station, Balehonnur.

(*v*) Spraying experiment with copper fungicides and detergents, Gantenaik Estate.

(*vi*) Strength of Bordeaux Mixture Experiment, Coffee Research Station, Balehonnur.

(*vii*) Spraying Experiment with copper fungicides, Coffee Research Station, Balehonnur.

A. **Pests :—**

(*i*) *Studies on the use of insecticidal formulations for the control of Stem-borer.*

Two experiments were in progress to find out the effect of various insecticidal formulations, especially B.H.C. and D.D.T. for the control of Stem borer.

The first of these was started in May, 1952, and with the use of 2 B.H.C. formulations and D.D.T. by themselves alone and in combination.

The removal of the borer affected trees was attended to in October before the flight period had commenced and again in April. These were counted and burnt immediately. The application of the insecticides was done just as the flight period commenced both in October and in April. This was studied by erecting 'in situ' cages in the field to study the flight period.

Locality: Balehonnur *Year:* 1952–53
Lay-out: Randomized *Replications:* 4
Treatments: 6
Plot size: Control plots :– 6 × 20 = 120 plants = 6·89 cents
Other plots :– 4 × 20 = 80 plants = 4·59 cents
Total area under the experiment: 1·48 acres.

TABLE PP–I : EXPERIMENT ON CONTROL OF STEM BORER I

Sl. No.	Symbol	Treatment	No. of trees at the commencement	Total bored trees removed for the year	% infested	% good trees
1	A	Control – no treatment	394	105	26·65	73·35
2	B	B.H.C. 50% wettable powder 8 lb in 40 gallon water	272	39	14·34	85·66
3	C	D.D.T. 50% wettable powder 16 lb in 40 gallon water	288	33	11·46	88·54
4	D	3:2 of B.H.C. and D.D.T. 12½ lb in 100 gallon water	290	37	12·76	87·24
5	E	Acrodel (9% gamma isomer) 12 lb in 100 gallon water	255	41	16·08	83·92
6	F	Acrodel 2 lb in 100 gallon water	259	44	16·99	83·01
		Mean :			16·38	83·62
		Significant or not :				No
		Critical difference :				22·18
		S. E. M. % :				12·45
		Conclusions :				D C E B F A

There was no significant difference between the various treatments. However, a mixture of B.H.C. and D.D.T. in the proportion of 3:2 (at the rate of 12½ lb. of the mixture in 100 gallons of water) gave the best control. This may probably be due to the good insecticidal action of B.H.C. on the borer beetle combined with the lasting residual action of D.D.T.

(*ii*) The second of these was started in April 1953 and included several new insecticidal formulations. Details of the experiment are as under.

Locality: Balehonnur *Year:* 1952–53
Lay-out: Randomized *Treatments:* 11
Replications: 4
Plot size: 5 × 16 = 80 plants = 6·61 cents
Total area under the experiment: 2·91 acres.

The treatments are:—

1. A. Control – no treatment.
2. B. Hexidole 950 (B.H.C.) 50% Wettable Powder – 8 lb in 40 gallon water.
3. C. GEIGY's Lindane 6·5% Wettable Powder – 8 lb in 40 gallon water.
4. D. GEIGY's 1250 25% D.D.T. + 25% B.H.C. – 8 lb in 40 gallon water.
5. E. Cela's Inexit Wettable Powder – 5 grams in 1 gallon water.
6. F. „ Inexit dust.

7. G. Bayer's Folidol E–605 Conc.–3·65 cc in 1 gallon water.
8. H. „ Folidol E–605 20% Wettable Powder–3·6 oz. in 40 gallon water.
9. I. Bayer's Folidol E–605 1·5% Dust.
10. J. Dedetane 50% DDT Paste–1 lb in 4 gallon water.
11. K. I.C.I.'s Gammexane Emulsion Conc.–48 oz. in (20% gamma isomer) 40 gallon water.

The plants are under observation and counts are recorded as in the earlier experiment.

(*iii*) *Experiment on Control of Eel-worm.*

To study the action of several insecticides and soil fumigants on eel-worm population in the coffee soils, an experiment was started at Elamadlu Estate, Durgadabetta, Chikmagalur District, Mysore State, in November, 1952. The experiment was laid out in a heavily eelworm infested area on a randomised replicated basis. Each plot has $5 \times 4 = 20$ plants, spaced at 5 feet distance. The plants are 3 to 4 years old.

Two spots in the central rows were marked and soil samples taken from them in $\frac{1}{2}$ foot and 1 foot layers, for examination of eel-worms. Two applications were done for the year in November and March and the soil samples taken in November (initial counts), 1952, March, 1953, (after first treatment) and in June (after second treatment).

Growth measurements were taken from the plants in the central rows of each replication. This was done by taking measurements once in November and then in August and calculating the extension growth made.

Systemic insecticide, Sytam, was sprayed on to the plants, whereas B.F.P.O. was applied to the roots; so also was Ekatox (parathion) liquid, in a crescent shaped trench near each plant. Hanane was applied in the form of capsules which were put close to the roots after scraping them. The capsules were then punctured and the hole made for inserting the capsule closed with soil. Calcium cyanide (Cyanogas) was put round the plants and tamped. Shell D.D. was injected with the soil injector at 10 cc. per spot at intervals of 1 foot along the central line between the rows of coffee. B.H.C. was irrigated near the root zone, whereas Ammonium sulphate was applied in shallow trenches within the drip-circle.

TABLE PP–II : COMPARATIVE TRIALS ON THE USE OF INSECTICIDES FOR CONTROL OF EELWORM

Locality: Elamadlu Estate, Durgadabetta. *Replications:* 4. *Year:* 1952–53.

Lay-out: Randomised. *Plot size:* Gross 5 × 4 = 20 plants = 1·15 cents.
Nett 3 × 2 = 6 plants = 0·344 cents.

Total area under experiment: 0·414 acres.

Sl. No.	Symbol	Treatment	Mean percentage survival of eelworms in the soil samples				Average increase in length per plant per branch
			After 1st application on 30-3-53 1–6″ depth	After 2nd application on 19-6-53 1–6″ depth	After 1st application 6–12″ depth	After 2nd application 6–12″ depth	
1	A	Control-no application.	345·00	268·75	115·48	92·41	1·203
2	B	B.F.P.O. 3·3% @ 1 pint per plant.	103·85	273·27	150·00	187·50	1·697
3	C	Sytam-sprayed @ 0·4% strength.	82·14	189·29	183·33	91·67	1·713
4	D	Ammonium sulphate @ 80 lb. nitrogen per acre (4 oz. per plant).	92·17	138·67	9·92	97·42	1·592
5	E	Hanane @ 2 gm. per plant applied as capsules	554·55	75·79	15·00	71·25	1·188
6	F	Calcium cyanide (Cyanogas) @ 3½ cwt. per acre (3 oz. per plant)	94·87	87·44	58·33	160·42	0·965
7	G	Shell D.D. @ 10 c.c. per spot.	51·39	79·96	2·50	126·25	1·639
8	H	Ekatox liquid @ 0·1% strength (¾ gal. per plant).	16·67	129·17	66·67	251·16	1·961
9	I	B.H.C. 50% wettable powder (5 gm. in 1 gal. water per plant).	93·33	53·75	87·50	137·50	1·540
		Mean.	159·33	144·01	76·53	135·06	1·500
		Significant or not.	Yes.	Yes.	Yes.	Yes.	Yes.

The results show significance for all the treatments. During the counts taken in summer, when the eelworm population tends to go lower down in the soil, Parathion gave the lowest percentage of eelworm survival at 1–6 inches depth whereas the B.H.C. gave the lowest percent survival at the same depth after the second application, when the water holding capacity of the soil has considerably increased thereby aiding the eelworm population to rise to the surface.

Critical difference.	807·8	517·4	366·4	91·37	0·759	
S.E.M.%	245·7	174·1	23·20	327·7	24·52	
	H G C D I F B A E	I E G F H D C A B	G D E F H I A B C	E C A D G I F B H	H C B G D I A E F	

Growth measurements also gave significant results

Shell D.D. came first in the control of eelworms at 6–12 inches depth during summer, but Hanane did so during counts taken in June. None of these results show any correlation between each other. Plants in the treatment with Parathion made the maximum extension growth.

B. **Diseases :**

iv) *Spraying experiment with copper fungicides and detergents– Balehonnur :* This experiment laid out during June 1951, is to find out the efficiency of the various copper fungicides, wetters, spreaders and detergents as against plain Bordeaux mixture of 2–2–40 strength. Spraying was done twice in the year, in Sept., 1952, and in May, 1953. Leaf counts were taken in Sept. as well as in Feb. to compute the extent of leaf disease and correlate it with the yields.

Locality : Balehonnur. *Year :* 1952–53.
Lay out : Randomized. *Replications :* 4.
Plot size : Gross – 8 x 15 = 120 plants = 6·8 cents.
Nett – 6 x 13 = 78 plants = 4·48 cents.
Total area under the Experiment : 3·27 acres.

TABLE PP–III : SPRAYING EXPERIMENT AT COFFEE RESEARCH STATION

Sl. No.	Symbol	Treatments	Effective % leaf survival		Yield of ripe cherry in lb./acre	Calculated clean coffee in cwt. per acre
			September 1952	February 1953		
1	A	Bordeaux mixture 2–2–40	66·17	34·40	292	2·32
2	B	do + 1½ oz Teepol in 40 gals	69·26	33·50	189	1·22
3	C	do + 1½ oz Lissapol do	57·30	42·38	209	1·62
4	D	do + 1 oz Agral II do	60·88	43·38	158	1·00
5	E	do + 1 oz Agral L.N. do	56·38	33·25	184	1·30
6	F	do + 7½ oz Corvus oil do	65·16	28·00	334	2·83
7	G	do + 6 oz Stanvac detergent in 40 gal.	58·03	44·50	369	1·57
8	H	do + 6 oz Shell Foliol in 40 gal.	71·31	34·18	111	0·68
9	I	Copper Sandoz 1 lb. + 1½ oz. Lissapol in 40 gal.	57·43	31·38	172	0·59
10	J	Perenox 1 lb. + 1½ oz Lissapol in 40 gal. water	56·95	47·13	143	1·06
11	K	Yellow Cuprocide 10 oz. + 1½ oz. Lissapol in 40 gal. water	55·44	41·63	188	1·51
12	L	Shell copper fungicide 1 lb. + 10 oz. Arkotine in 40 gal. water	54·31	32·88	223	1·71
		General Mean	60·73	37·22	214·3	1·45
		Significant or not	Yes	No	Yes	
		Critical difference	19·80	18·61	106·4	
		S.E.M.%	16·65	25·51	20·71	
		Conclusions :				
		Sept. 1952 leaf count	H B A F D G I C J E K L			
		Feb. 1953 leaf count	J G D C K A H B L I E F			
		Yield of ripe cherry	G F A L C B K E I D J H			

The results show significant difference in the yield. Bordeaux mixture of 2–2–40 strength with Stanvac detergent gave the highest yield of ripe cherry per acre, with Bordeaux mixture + Caltex Corvus oil coming next.

Most of the proprietary copper fungicides were not successful, only Shell Copper fungicide coming fourth in the order.

No significance is noticed in the February leaf survival percentages, but there is significance in the September leaf survival percentages. No correlation between yield and leaf counts is seen.

(v) *Spraying experiment with copper fungicides and detergents at Gantenaik Estate, Balehonnur.*

This experiment was started in June, 1952, at the Gantenaik Estate, Balehonnur. The purpose of the experiment is to find out the effect of various fungicides and detergents on leaf-disease and to study whether it would be possible to replace the time-old Bordeaux Mixture with the ready-made products which are easy to mix and spray.

The leaf-counts were taken in the months of September and February. The spraying was done in September and in May of each year.

Locality: Gantenaik Estate, Balehonnur. *Year:* 1952–53.
Lay-out: Randomized.
Replications: 4. *Treatments:* 8 (as in Table PP–IV).
Plot size: gross: 3 x 8 = 24 plants = 1·40 cents.
nett: 1 x 6 = 6 plants = 0·34 cents.
Total area under the Experiment: 0·50 acre.

TABLE PP–IV: GANTENAIK SPRAYING EXPERIMENTS

Sl. No.	Symbol	Treatment	Effective % of leaf survival		Yield of ripe cherry in lb./acre	Calculated clean coffee in cwt./acre
			September 1952	February 1953		
1	A	Coppesan – 1 lb. in 40 gallon water.	45·29	54·16	1135	0·80
2	B	Blitox – 1 lb. in 40 gallon water.	49·52	48·79	1459	1·44
3	C	Bordeaux mixture – 2–2–40 + Adhesive Y. F. 2732 1·6 lb.	41·22	39·88	700	0·51
4	D	Perenox 1 lb. in 40 gallon water + 1·6 lb. of Adhesive.	47·19	57·13	1295	1·49
5	E	Perenox 1 lb. in 40 gallon water.	55·02	53·00	1080	0·76
6	F	Bordeaux mixture – 2–2–40 + 6 oz. Sandovit.	41·90	47·38	523	0·54
7	G	Nacco Nol N.R. 1·6 lb. in 40 gallon water.	52·07	61·00	1225	0·91
8	H	Bordeaux Mixture – 2–2–40.	47·02	47·38	924	0·70
		General Mean:	47·40	51·09	1117·6	0·89
		Critical difference:	10·59	22·13	388·75	
		S.E.M. %:	10·91	21·15	17·94	
		Conclusions:			all equal	
		for September 1952 leaf counts:—			E G B D H A F C	
		for February 1953 do :—			G D A E B F H C	

The yields recorded are basic as they were from the plots which were laid out for the experiment only during the beginning of the year. However, the yields show significant difference between the plots treated with various fungicides. Plot treated with Blitox (treatment B.) gave the highest yield followed by Perenox plus Adhesive (treatment D.).

No comparison between the yield and the effective precentage of leaf survival (E.P.L.S.) could be arrived at as they do not show any similarity.

(vi) *Strength of Bordeaux Mixture Experiment, Coffee Research Station, Balehonnur.*

This experiment was started in June, 1951, in the Crawford Area of the Coffee Research Station, Balehonnur. The purpose of the experiment is to try different strengths of Bordeaux mixture and compare them with a factory bye-product containing 80% copper sulphate, 10% zinc sulphate and 10% nickel sulphate with 1% free sulphuric acid.

Leaf-counts were taken in September, 1952, and in February, 1953. Spraying was undertaken in September and the following May of each year commencing from September, 1951.

Locality: Balehonnur *Year:* 1952–53
Layout: Randomized *Plot size:* gross:– 6 x 20 = 120 plants = 7·9 cents
Replications: 4 nett:– 4 x 14 = 56 plants = 4·6 cents
Treatments: 4
Total area under the experiment: 1·22 acres.

TABLE PP–V: STRENGTH OF BORDEAUX MIXTURE, BALEHONNUR

Sl. No.	Symbol	Treatment	Effective % of leaf survival		Yield of ripe cherry in lb./acre	Calculated clean coffee in cwt./acre
			September 1952	February 1953		
1	A	Bordeaux Mixture 2–2–40.	49·81	39·88	444	2·35
2	B	1½–1½–40 do	53·82	38·00	447	2·41
3	C	1–1–40 do	50·72	44·38	411	2·01
4	D	Parry's Bye-pooduct 2½–2½–40.	49·29	31·88	550	3·30
		General Mean:	50·91	38·54	463	2·52
		Significant or not:	No	No	Yes	
		Critical difference:	10·94	17·34	111·8	
		S. E. M. %	9·86	20·65	13·07	
		Conclusions:	B C A D	C A B D	D B A C	

Yields alone showed significant results. Parry's bye-product gave the highest yield. No correlation between the yield and leaf counts was observed.

(vii) *Spraying experiment with copper fungicides, Balehonnur.*

This experiment was started in May, 1953, to test the efficacy of some of the new fungicides which are easy to prepare into mixtures for spraying as against plain Bordeaux mixture the preparation of which is a laborious process. The first spraying was done during May, 1953, and the plots are under observation. Yield records will be maintained.

Locality: Balehonnur *Experiment started:* 1953

Plot size: gross:–8 × 15 = 120 plants = 6·8 cents *Replications*: 4
nett:– 6 × 13 = 78 plants = 4·45 cents

Total area under the experiment: 1·09 acre.

Treatments:

1.	A. Wetcol–15	–	10 lb in 100 gal. water
2.	B. Zinc–Cop.	–	5 lb in 100 gal. water
3.	C. Cupravit	–	2½ lb in 100 gal. water
4.	D. Bordeaux mixture	–	2–2–40 strength

(1½ oz. of Teepol to be added to 40 gallons of the mixtures in all treatments.)

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Graduate Assistant in Agronomy.

H. T. Ranga Setty,
Graduate Assistant in Entomology.

REPORT OF THE SENIOR LIAISON OFFICER

A. General :

1. *Tours :* 87 days were spent on tour and 130 estates in the following coffee areas were visited and as many planters as could be met were contacted.

1. Bababudangiris; 2. Nilgiri-Wynaad; 3. Kalasa, Hirebile and Javali; 4. Saklespur, Arehalli, Hanbal, Mudigere and 5. Biligiris and Anamalais

2. *Correspondence :* Correspondence related mainly to advisory work on coffee problems such as manuring, shade, borer and similar querries. The total number of letters received was 1520 and the total number of letters despatched was 1021.

3. Particular attention was paid to the following problems during the course of liaison tours.

(i) Measures to prevent soil erosion and leaching of soils; (ii) provision of suitable shade trees for different localites; (iii) manuring; (iv) introduction of disease resistant varieties; (v) leaf disease and black-rot and their control; (vi) the coffee stem borer and its control and, (vii) green bug and its control, and suitable advice rendered with particular reference to locality, aspect, micro-climatological factors and more important, the economics of any recommendation.

B. Research :

All these experiments were undertaken in consultation and in active co-operation of the technical officers at the Coffee Research Station, Balehonnur.

I. **Botany :** 4. Observations on plant material obtained from Balehonnur, and from Ghattedhulla were continued. These selections are mainly intended to study their suitability to the area and to multiply them.

Arabica coffee – 1949 clearing.

Sl. No.	Selections	Procedure adopted	Remarks	
1	S.288, S.645, S.795, S.531 × Kents, S.26 × Kents.	Gorwn in non-replicated plots.	S.531 x Kents, S.26 x Kents and S.795 were more vigorous than others.	
2	S.288, S.645, S.795 and S·446	Under replicated trials. Layout–Latin Square.	*Yield per acre* Fruit in lb.	Clean coffee. in cwt.
		A. S–288	808	1·20
		B. S–645	1366	2·03
		C. S–795	1897	2·82
		D. S–446	3746	5·57
		Mean	1954	2·91
		S.E.M.%		16·22
		Sig. or not		Yes.
		Critical dif	1095	1·63
		Conclusions		D, $\overline{C\ B\ A}$

Equally with yield, S·446 was easily the best in appearance, while the order of merit among the other selections was 795, 645 and 288. But after the crop in April–May of 1953, S.446 looked very tired while 795 was in good heart.

5. After a physical inspection of the standing plants from selections S.446, S.795, S.645, S.531 x Kents and S.26 x Kents, with reference to yield data for 1953, 18 plants were marked out. The blossom was artificially forced out and the following crosses were done:

	Male					*Female*		
	Plot No.	*Row No.*	*Plant No.*			*Plot No.*	*Row No.*	*Plant No.*
446	4	12	3	x	645	2	11	4
446	4	12	3	x	795	3	4	5

6. Selected plants of S.795, S.446, S.645 and the cross between Kent and S.531 and S.26 were selfed for obtaining pedigree stock seed material.

7. Seeds from selected plants of estate selections noted under were sown to be planted out in individual blocks in the 1953 clearing– S.702 S.288, S.645, S.795 and S.446.

Robusta coffee.

8. *Intra-specific crosses between promising selections of robusta:* Eight trees at Ghattedhulla recorded below had proved their merit by the regularity of bearing and the high average yields varying from 272 oz. per plant against a field average of 61 oz. during the years 1940–41 to 1945–46. These were divided into two groups of four sets of crosses and their reciprocals were effected in 1947. Plants from these were put in at Chethalli in 1949.

Sl. No.	Crosses	Procedure adopted	Remarks
1	53–33×58–31 and reciprocal.	Direct and reciprocal crosses alternatively in the same line.	No perceptible difference between direct and reciprocal crosses.
2	59–9×58–16 and reciprocal.	do	do There were 9 plants in 100 with bronze coloured leaves.
3	49–28×53–28 and reciprocal.	do	53–28 and 49–28 at Ghattedhulla had lately developed leaf disease but the crosses at Chethalli had no disease.
4	63–8×46–20 and reciprocal.	do	No perceptible difference between direct and reciprocal crosses.

The second stage of hybridization in the scheme of crosses was taken up. Some promising trees, after a physical inspection, were selected and were

crossed in pairs. The pairs of plants were watered on different dates so that they may come to blossom on different dates to avoid chance crosses.

9. *Vegetative propagation – Robusta:* The propagation of clonal material for manurial experiments from 50 robusta plants was continued.

10. The propagation of clonal material for manurial experiments from Arabica plants was discontinud in view that an elaborate manurial experiment has already been laid with plants from seed, and treatments imposed in the 1952 clearings.

II. **Chemistry:**

11. *Catalyzatian of plant nutrients*: This experiment was laid in collaboration with the Bio-Chemist, Indian Institute of Science, Bangalore, to study the effect of certain catalysts on the availability of plant foods. The last period when the catalyst chemicals were applied was in Dec. 1951, and the chemicals were not received afterwards. The results so far obtained are furnished below.

Locality: Coffee Research sub-station, Chethalli.

Treatments: A = 28 lb. Ferrous sulphate per acre.
B = 20 lb. Potassium permangante per acre.
C = 40 lb. Catalyst product.
D = 80 lb. do
E = Control – No catalyst.

Lay-out: 5 x 5 latin square.

Area of plot: Gross 10 x 7
Nett 8 x 5

Variety of Coffee: Arabica Coorgs about 20 years.

Shade: Natural shade.

TABLE L–I: YIELD OF COFFEE IN RELATION TO APPLICATION OF CATALYSED MANURES

YEAR	Yield of ripe cherry in lb. and clean coffee in cwt. calculated per acre. TREATMENTS					Std. error % gen. mean	Critical dif. P = 0·05	Sig. or not	Conclusions
	A	B	C	D	E				
1950—									
Ripe cherry	1685	1330	1436	744	1538	29·50	1231	No	AECBD
Clean Coffee	3·00	2·38	2·56	1·33	2·75	29·50		No	AECBD
1951—									
Ripe cherry	3012	2424	2844	1986	2658	9·74	775	No	ACEBD
Clean Coffee	4·48	3·61	4·23	2·96	3·96	11·25	1·15	No	ACEBD
1952—									
Ripe cherry	540	804	594	372	546	20·92	367	No	BCEAD
Clean Coffee	0·80	1·20	0·88	0·55	0·81		0·55	No	BCEAD
1953—									
Ripe cherry	4080	4668	4050	3408	4254	11·78	1482	No	BEACD
Clean Coffee	6·07	6·95	6·03	5·07	6·33	11·78	2·21	No	BEACD

No statistical difference has been noted between treatments.

12. *Manurial experiment on arabica coffee:*

Locality: Coffee Research sub-station, Chethalli, Terraced field.

Lay-out: Factorial design 4 x 2 x 2 with 3rd order interaction confounded.

Treatments:—

Nitrogen at 4 levels,	$N_0 = 0$ lb. N.	$N_2 = 90$ lb. N.
	$N_1 = 60$ lb. N.	$N_3 = 120$ lb. N.
P_2O_5 at 2 levels,	$P_0 = 0$ lb.	
	$P_1 = 30$ lb.	
K_2O at 2 levels,	$K_0 = 0$ lb.	
	$K_1 = 40$ lb.	

Total No. of plots: 48. Planted $6\frac{1}{2}' \times 6\frac{1}{2}'$ square.

Size of plot: Gross 7 x 7 Variety: 446 second generation.

Nett 5 x 5 Basket plants used and planting completed on 22–2–1952.

Palwan planted for every two coffee supplies in every row.

Soil samples from each one of the 41 plots have been sent to Balehonnur for analysis.

LAY OUT OF MANURIAL EXPERIMENT ON ARABICA COFFEE

Planted: *August 1952.*

First Manuring: *May 1953.*

1 $N_3P_1K_0$	2 $N_0P_1K_1$	3 $N_0P_0K_0$	4 $N_3P_0K_1$
13 $N_2P_0K_1$	14 $N_1P_0K_0$	15 $N_2P_1K_0$	16 $N_1P_1K_1$

5 $N_2P_0K_1$	6 $N_3P_1K_1$	7 $N_0P_0K_0$	8 $N_2P_1K_0$
17 $N_1P_0K^1$	18 $N_1P_1K_0$	19 $N_0P_1K_1$	20 $N_3P_0K_0$

9 $N_2P_1K_1$	10 $N_0P_1K_1$	11 $N_2P_0K_0$	12 $N_1P_0K_1$
21 $N_3P_0K_1$	22 $N_0P_0K_0$	23 $N_3P_1K_0$	24 $N_1P_1K_0$

25 $N_0P_1K_0$	26 $N_3P_0K_0$	27 $N_0P_0K_1$	28 $N_1P_0K_1$
37 $N_1P_1K_0$	38 $N_2P_0K_0$	39 $N_3P_1K_1$	40 $N_2P_1K_1$

29 $N_2P_1K_1$	30 $N_2P_0K_0$	31 $N_3P_1K_0$	32 $N_1P_1K_1$
41 $N_0P_0K_1$	42 $N_3P_0K_1$	43 $N_0P_1K_0$	44 $N_1P_0K_0$

33 $N_1P_1K_1$	34 $N_2P_1K_0$	35 $N_3P_1K_1$	36 $N_0P_0K_1$
45 $N_1P_0K_0$	46 $N_0P_1K_0$	47 $N_3P_0K_0$	48 $N_2P_0K_1$

III. Plant Protection-Mycology.

13. *Use of wetters and spreaders with Bordeaux mixture :*

(a) *Use of Teepol–X at different strengths:*

Locality: Ghattedhulla (Coorg).

Lay-out: Randomised block, 4 treatments x 6 blocks.

Size of plot: Gross = 4 × 30.
Nett = 3 × 28.

Treatments: A. Bordeaux 2–2–40.
B. do + ¾ oz. Teepol.
C. do + 1½ oz. do
D. do + 3 oz. do

TABLE L–II : LEAF COUNTS AND YIELD RECORDS

	A	B	C	D	Mean	S.E.M. %	Sig. or not	C.D.	Conclusions
1	2	3	4	5	6	7	8	9	10
Leaf Counts									
February 1947	11·1	14·3	14·1	14·2	13·4	8·06	Yes	2·3	$\overline{BDC}$,A
September 1947	23·4	28·5	29·6	29·1	27·7	4·73	Yes	2·8	$\overline{CDB}$,A
February 1948	15·7	16·6	18·4	18·1	16·7	5·33	Yes	1·9	$\overline{CDBA}$
September 1948	24·6	24·4	25·4	23·2	24·4	6·27	No	4·6	$\overline{CABD}$
February 1949	11·9	13·9	14·7	14·7	13·6	4·01	Yes	1·6	$\overline{CDB}$,A
September 1949	25·7	32·5	21·7	20·9	25·9	5·40	Yes	4·2	BA,$\overline{CD}$
February 1950	10·2	11·7	11·6	11·5	11·3	4·28	No		$\overline{BCDA}$
September 1950	45·2	44·4	41·6	40·9	43·0	5·65	No	7·3	$\overline{ABCD}$
February 1951	21·2	22·8	23·6	22·5	22·5	8·46	No	5·7	$\overline{CBDA}$
September 1951	60·3	58·7	57·5	59·1	58·9	2·86	No	5·1	ADBC
February 1952	24·6	24·1	24·8	24·4	24·5	4·09	No	3·0	$\overline{CADB}$
September 1952	39·1	40·4	38·4	36·2	38·5	3·99	No	4·6	$\overline{BACD}$
February 1953	23·0	23·5	21·8	21·9	22·6	2·91	No	2·6	$\overline{BADC}$
Yield									
1948–Fruit lb.	3520	4840	4440	3680	4115		Yes		$\overline{BC}$ $\underline{DA}$
Cl. coffee cwt.	5·24	7·20	6·61	5·65	6·13		Yes		$\overline{BC}$ $\underline{DA}$
1949–Fruit lb.	2683	2077	2680	2930	2593	16·35	No	1543	$\overline{ACDB}$
Cl. coffee cwt.	3·93	3·09	3·93	4·36	3·86		No	2·30	$\overline{ACDB}$
1950–Fruit lb.	3680	4300	4240	3200	3855		No		$\overline{BCDA}$
Cl. coffee cwt.	5·47	6·40	6·34	4·76	5·74		No		$\overline{BCDA}$
1951–Fruit lb.	3880	5920	5380	5100	4820	13·35	No	1939	$\overline{BCDA}$
Cl. coffee cwt.	5·77	8·81	8·01	7·59	7·17	2·89	No		$\overline{BCDA}$
1952–Fruit lb.	4236	4672	4016	4600	4380	17·15	No	2260	$\overline{BDAC}$
Cl. coffee cwt.	6·30	6·95	5·98	6·85	6·52		No	3·36	$\overline{BDAC}$
1953–Fruit lb.	5760	6920	6850	6380	6480	8·13	No	1588	$\overline{BCDA}$
Cl. coffee cwt.	8·57	10·30	10·19	9·49	9·64	8·13	No	2·36	$\overline{BCDA}$

In the early years of the experiment, Teepol has exercised some influence, while later it is not appreciable. According to leaf counts, generally doses of Teepol 1½ oz. and ¾ oz. top the lists. But in the yields it is mostly ¾ oz. that does it.

(b) *Use of Teepol and Albolineum:* This experiment which was started in the year 1948 to compare Albolineum with Teepol–X was continued.

Locality: Ghattedhulla. *Lay-out:* Randomised blocks.

Size: 3 × 6 blocks.

Treatments: A. Bordeaux 2–2–40 plain.
B. do + 1 oz. Teepol X.
C. do + 2 oz. Albolineum.

TABLE L–III: RESULTS OF TEEPOL AND ALBOLINEUM AS SPREADERS

	A	B	C	Mean	S. E. M. %	Sig. or not	C. D.	Conclusions
Leaf Counts								
September 1948	22·2	25·8	25·8	24·6	7·80	No	6·0	$\overline{CBA}$
February 1949	11·9	13·5	11·8	12·4	7·3	No		$\overline{BAC}$
September 1949	21·8	22·0	23·9	22·5	9·4	No		$\overline{CBA}$
February 1950	10·0	11·9	13·3	11·7	7·1	Yes	2·7	$\overline{CB}$, A
September 1950	47·6	47·5	47·6	47·6	4·54	No	2·3	$\overline{ACB}$
February 1951	15·2	15·9	17·2	16·1	4·61	No	6·9	$\overline{CBA}$
September 1951	57·3	60·7	62·4	60·2	6·95	No	13·2	$\overline{CBA}$
February 1952	24·8	25·3	26·2	25·5	4·06	No	3·3	$\overline{CBA}$
September 1952	33·8	39·5	32·1	35·2	3·31	Yes	3·7	B, $\overline{AC}$
February 1953	26·6	27·1	26·8	26·8	2·42	No	2·0	$\overline{BCA}$
Yield per acre								
1949–Fruit lb.	2563	2653	2993	2731	14·2	No		$\overline{CBA}$
Cl. coffee cwt.	3·81	3·95	4·46	4·07	14·2	No		$\overline{CBA}$
1950–Fruit lb.	2860	3380	3700	3200	7·30	No		$\overline{CBA}$
Cl. coffee cwt.	4·26	5·03	5·51	4·76	7·30	No		$\overline{CBA}$
1951–Fruit lb.	2780	2160	2520	2480	9·67	No	755	$\overline{ACB}$
Cl. coffee cwt.	4·14	3·21	3·75	3·69	9·67	No	1·12	$\overline{ACB}$
1952–Fruit lb.	2856	3200	2860	2980	10·85	No	1042	$\overline{BCA}$
Cl. coffee cwt.	4·25	4·76	4·26	4·43	10·85	No	1·55	$\overline{BCA}$
1953–Fruit lb.	3220	3200	3240	3220	10·58	No	1073	$\overline{CAB}$
Cl. coffee cwt.	4·79	4·76	4·82	4·79	10·58	No	1·60	$\overline{CAB}$

The data are not generally statistically significant except in two observations. But the order of merit, as per indications are that Bordeaux with Albolineum or Teepol probably is better than plain Bordeaux.

(c) *Detergent Experiment with Bordeaux at Coffee Research Sub-station, Chethalli:*

Treatments: A. Bordeaux plain 2–2–40.
B. do + Teepol X.
C. do + Corvus oil.
D. do + Foliol.
E. do + Stanvac Detergent 40E.

(1) *At single dose:*

Teepol X	Corvus oil	Foliol	Stanvac Detergent 40E
½ oz.	5 oz.	4 oz.	6 oz.

(2) *At double dose:*

1 oz.	10 oz.	8 oz.	12 oz.

TABLE L–IV: DETERGENT EXPERIMENT AT COFFEE RESEARCH SUB-STATION, CHETHALLI.

	September 1951	February 1952	September 1952	February 1953	Yld/acre 1952		Yld/acre 1953	
					Fruit lb.	Cl. Coffee Cwt	Fruit lb.	Cl. Coffee cwt
A	65·6	25·0	53·3	28·0	1300	1·93	2604	3·88
B	68·0	26·2	50·3	28·9	1080	1·61	2289	3·41
C	68·5	25·3	50·6	29·4	1129	1·68	2121	3·16
D	68·1	25·2	51·9	26·1	955	1·42	2457	3·66
E	67·1	26·1	51·5	29·0	1343	2·00	2373	3·53
Mean	67·5	25·6	51·5	28·3	1162	1·73	2373	3·53
S.E.M.%	2·17	2·38	4·41	5·08	11·76		5·96	
Sig or not	No	No	No	No	No		Yes	
Critical Difference	4·3	1·8	6·7	4·2	411	0·61	418	0·62
Conclusions	CDBEA	BECDA	ADECB	CEBAC	EACBD		ADEBC	
S = Single dose	66·5	25·2	51·6	29·0	1247	1·86	2289	3·41
D = Double dose	68·5	25·9	51·5	27·6	1077	1·60	2436	3·63
Mean	67·5	25·6	51·5	28·3	1161	1·73	2373	3·53
S.E.M.%	1·23	2·05	1·35	2·59	7·92		5·88	
Sig. or not	No	No	No	No	No		No	
Critical Difference	2·4	1·5	2·0	2·1	267	0·40	407	0·61
Conclusions	DS	DS	SD	SD	SD		SD	
Significant interactions	No	No	No	No	No		No	

The figures are not statistically significant except in case of yield for 1953. The addition of spreades however seem to have increased protection.

14. (a) *Copper Sandoz and Bordeaux, Coffee Research Sub-Station, Chethalli. September,* 1949:

Layout: Randomised 4 x 5.

Treatments: A. Control (no spraying)
B. Bordeaux mixture 2–2–40.
C. Copper Sandoz 2 lb. in 40 gallons.
D. Copper Sandoz 1 lb. in 40 gallons.

TABLE L–V: COMPARISON OF BORDEAUX WITH COPPER SANDOZ

	A	B	C	D	Mean	S.E.M. %	Sig. or not	C.D.	Conclusions
February, '50	13·5	17·3	16·2	17·5	16·1	7·34	No	3·6	D B C A
September, '50	18·1	42·4	28·1	31·3	24·0	12·01	Yes	8·9	B,D,C,A,
February, '51	23·0	20·9	20·8	21·5	21·5	5·09	No	3·4	A D B C
September, '51	62·7	68·6	72·1	70·8	68·6	3·53	No	7·5	C D A B
February, '52	22·3	29·0	27·0	27·2	26·9	5·85	No	4·8	B D C A
September, '52	30·8	43·1	37·5	34·6	36·5	4·71	Yes	5·3	B,C D A
February, '53	19·9	29·6	27·5	27·8	26·2	6·78	Yes	5·5	B D C,A
Yield per acre									
1952–Fruits in lb.	501	1586	1170	973	1057	17·45	Yes	569	B C D A
Cl. coffee in cwt.	0·75	2·36	1·74	1·45	1·57	17·45	Yes	0·85	B C D A
Yield per acre									
1953–Fruits in lb.	2872	4757	4607	4286	3729	10·11	Yes	1162	B C D,A
Clean coffee cwt.	4·27	7·08	6·86	6·38	5·55	10·11	Yes	1·73	B C D,A

The use of a fungicidal spray increases leaf retention, but plain Bordeaux tops the list in the majority of observations, and whenever the data are statistically significant, it is the best. Copper Sandoz, at best, is only equal to Bordeaux.

(b) *Bordeaux and other Bordeaux substitutes:*

Layout: Randomised plot replicated 5 times.

Size of plot: One row of coffee trees with 15 trees in each row – One common guard row between any two adjacent treatments.

Treatments: A. Wetcol 4 lb. in 40 gallons of water.
B. Bordeaux 2–2–40.
C. Control – No treatment.
D. Cupravit 1 lb. in 40 gallons of water.
E. Yellow Cuprocide 10 oz. in 40 gallons of water.

The strength of the Bordeaux substitutes have been adjusted to the same copper content as that in Bordeaux 2–2–40.

The plan and layout is given below—

E B C A D : C B E D A : D B A C E : B E D A C : A D C E B

The treatments were first imposed in June.

IV. Plant Protection-Entomology.

15. *The Coffee Stem Borer – (Xylotrechus quadripes Chev.)*

(a) *Experiment* 1: The experiments started in 1949 for the control of borers at Coffee Research Sub-Station, Chethalli, and at Biccode Estate, Mysore, were continued. The treatments consisted of 1%

D.D.T. and 1% B.H.C. and control. Several rounds of borer infested trees were removed during the several years prior to each one of the flight seasons (flight seasons are April–May and October–December) and burnt. The data accrued so far, are given in table below:—

Particulars	D.D.T.	B.H.C.	Control
Coffee Research Sub-Station, Chethalli:			
Initial No. of trees treated	1109	1074	1061
Bored trees removed: 1950	179	150	189
1951	162	140	184
1952	25	13	63
1953 upto end of June	5	2	23
Biccodé Esaate:			
Initial No. of trees treated	1540	1663	1542
Bored trees removed: 1950	204	200	427
1951	104	78	154
1952	22	11	64
1953 upto end of June	4	0	17

Both D.D.T. and B.H.C. effect a good control of borer, but B.H.C. is better. In control also, it will be noted that the incidence has progressively gone down from year to year. This is becasuse the beetles in control plots cannot be prevented from passing on to treated plots, and thereby getting killed.

(b) *Experiment 2:* Laboratory trials for assessing the insecticidal value in as far as it is concerned with the control of coffee stem borer were undertaken in April, 1953, using formulations containing Chlordane, Toxophene, and Folidol 605E. (a Farbenfabriken Bayer product–Paranitro–phenyl–dialkyl–thiophosphate, an organo phosphorus compound.)

Empty cigarette tins with one side open and the other side covered with a wire-gauze were placed over petri dishes. On the petri dishes were stuck white card-boards with a number of slits made in them to afford positions for borer beetles to lay eggs. These card-boards were treated with various formulations with a sprayer and covered over by the cigarette tins. Inside each tin, six borer beetles, 3 males and 3 females were let in.

Laboratory treatments with various chlorinated organo phosphorus compounds.

	Single dose	*Double dose*
A = Chlordane in water	0·0875%	0·1750%
B = B.H.C. in water	1·0%	2·0%
C = Control	—	—
D = Toxophene in water	1·0%	2·0%
E = Folidol 605E in water	0·025%	0·050%

Single doses were the ones recommended by the companies marketing these products.

The observations made in this connection are given below:—

Treatment	Single Dose		Double Dose	
	Mortality	Whether eggs laid	Mortality	Whether eggs laid
A	All 6 died in 2 days	No eggs laid	All 6 died in 2 days	No eggs laid
B	All 6 died in 4 days	do	do	do
C	3 died in 5 days and 3 alive for over a fortnight	Yes	1 died in one day; rest alive over a fortnight	Yes
D	All 6 died in 2 days	No	All 6 died in 2 days	No
E	do	do	do	do

(c) *Experiment* 3: In the light of the above experiment a field trial was laid out. The quantity of the formulations required for 40 gallons of water was based on the single doses mentioned in the experiment 2 above, in as much as the single doses were practically as effective as the double doses.

Treatments: Replications: 6.

A 70% Chlordane = 8 oz. (Intox–8 of Sandoz Products) in 40 gallons of water.

B 50% B.H.C. = 8 lbs. (Agrocide of I.C.I.) in 40 gallons of water.

C Control = No treatment.

D 40% Toxophene = 10 lbs. in 40 gallons of water.

E 46·6% Folidol = 3½ oz. in 40 gallons of water.

Plan of Borer Experimental Plots.

B C A D E : C A D B E : E D A C B : D C E A B : C D B E A

ROAD

A C E B D : E D B C A : D A E B C

(d) *Experiment* 4: Bored stems from the field, 6 in number, were removed, split and examined during several months. Details are given below:

Particulars	Borers observed				
	Small grubs	Medium grubs	Big grubs	Pupae	Adult
November 1952	4	—	2	2	—
December	3	—	1	1	1
January 1953	—	—	2	2	—
February	—	1	1	—	—
March	1	—	2	—	—
April	20	—	10	—	2
May	12	—	2	1	1
June	4	10	—	—	—

This is to be expected in view that the life period from egg to beetle may be 6 months, 12 months, 18 months or 24 months and that the grubs

under each cycle may all be present in the same stems at any particular part of the year.

(e) *Experiment* 5: *Field cages for borer studies:* In pursuance of the directions of the Research Committee, three field cages have been erected enclosing coffee stems in the field and are covered with mosquito-net cloth. The coffee trees are being infected with borers. The behaviour of the beetles in subsequent seasons while emerging from the stem and the extent of control that could be secured by using systemic poisons to the soil will be studied.

16. *Eel-worms.*

The earlier experiments have not taken into account the incidence of the nematodes in the different layers of soil during different parts of the year. It was found that Root-Knot eelworms were in a measure controlled by growing *Crotalaria spectabilis*, and *black Mustard.* It was proposed to try the same treatments against coffee nematodes. For this purpose, small plots were sown to these materials in March, in April and sowings proposed to be done in subsequent months also. Soil samples within first 9 inches from top from the March-sown plots were examined for parasitic eel-worms. *There were no nematodes in Crotalaria spectabilis,* but there were plenty of them *in Mustard.* However, the examination of the control plot revealed none of them. It seemed that the eelworms under the adverse conditions prevailing during the hot months migrate and are likely to be found at lower depths where certain amount of moisture will be available. In view of the fact that the Mustard and *Crotalaria spectabilis* plots were being watered for well over a month, while the control plots were not watered at all, it would appear as though *Crotalaria* exerts a certain amount of inhibition on eel-worm.

Consequent on this information, it was thought necessary to study the incidence of the eel-worms in eel-worm soils during the different parts of the year. In collaboration with W/Cdr. J. H. Sprott, soil samples at four 9 inches layers were collected and examined in April. The first 9 inches from top had no nematode. The second 9 inches had none, but the third and fourth 9 inches layers had plenty of them. This seems to fortify the surmise that the movements of these pests in the soil is according to optimum moisture conditions required for it.

As a further step to these, further layers of 9 inches soils deeper down up to six feet will be examined. Details for the first 3 feet examined are given below.

Incidence of parasitic eel-worms at different levels from ground surface.

Depth of soil samples	Coffee soil	Mustard soil	Crotalaria spectabilis soil
0 – 9″	Yes	Yes	Yes
9 – 18″	Few	Yes	Yes
18 – 27″	Nil	Yes	Yes
27 – 36″	Nil	Nil	Nil

17. *Mealy bugs on the roots of Arabica coffee.*

In a 1951 Arabica clearing in Mattaparamboo estate, Pollibetta, consisting of two blocks, there have been considerable supply losses. Out of roughly 8050 plants put in, about 4780 were observed to have been lost towards the end of December, 1952, and this approximately comes to 60%. The losses were attributed to the incidence of Mealy Bug, mainly on the collar and the roots. To combat this pest, the manager had treated the affected collar with Agrocide suspension at a strength of ½ to ¾ lb. per gallon of water. The treatment did not seem to have effected any control. On the contrary, the concentration of the chemical was probably a little too drastic and injurious to the coffee.

An experiment was laidout on an acre of this coffee, using some of the modern insecticides that have been reported to control Coccids. The details of the experiment are given below:—

Treatments: A – H.E.T.P. at 1 lb. in 100 gallons of water.

B – Folidol E 605 (a Bayer's Parathion product based on Paranitro-phenyl-dialkyl-thiophosphate) at 17·6 oz. in 100 gallons of water.

C – Intox-8 (Chlordane) at the rate of 8 oz. in 100 gallons water.

D – Toxaphone (40%) at 3 lb. in 100 gallons water.

E – Control.

The treatments were applied by pouring the solution at the base of each coffee plant (and also shade plants) at the rate of a little less than a quart. The plants were also sprayed with the same material to destroy any bug on the aerial part. In this way, 100 gallons were sufficient to treat 240 plants. The plan and lay-out are given below:—

I	II	III	IV	V	VI
CEDBA :	CDEBA :	ADBEC :	BDEAC :	BCAED :	CADBE

Replications = 6

Size of each plot = 2 rows × 20 plants. No guard rows, in view that the plants are only one year old and do not touch one another.

18. *Control of ant.*

Since it is generally considered that the ants shepherded the bugs, measures to control these were also adopted. The experimental field was divided into 4 blocks across the lay-out, and to each one of them was assigned one of the undermentioned treatments.

a. Calcium cyanamide dusting on the surface of the soil at the rate of 250 lb. per acre.

b. Intox-8, at 8 oz. in 100 gallons sprayed on the surface of the soil, at the rate of 500 gallons per acre.

c. D. D. T. 2% emulsion sprayed on the soil at the rate of 500 gallons per acre.

d. Control.

Wherever holes made by ants could be seen, Calcium cyanamide was applied to them.

19. *Method of observation.*

The counting of the root mealy bugs on uprooted plants was not feasible and should be considered as not reliable. When plants are pulled or dug out, not only are the plants lost to the field, but also, the bugs drop out and get mixed up with the soil. Therefore, as an alternative, a count of the supply losses under each treatment is proposed to be noted. The initial counts of plants under each treatment is given below:—

Treatment	Plants put in 1951 and alive	Plants supplied in 1952 and which are alive	Present vacancies towards the end of December 1952
A	126	81	33
B	149	71	20
C	135	84	21
D	130	90	20
E	135	89	16
Total	675	415	110

While examining the roots of 1951–planted Arabica plants towards the end of December 1952, it was found that the mealy bugs were found more on the lateral roots than near the collar region of the stem. In view of this it was felt that surface treatment with formulations at the base of the coffee trees may not give the correct picture. Therefore a modified experiment was designed and executed on the following lines. The main treatments were just the same except that they were done at 2 concentrations. The chemicals themselves were injected into the soil over the entire plot under each treatment with the help of a soil injector. The details of the experiment are as follows:—

Main treatments: A. H.E.T.P.
B. Folidol E–605.
C. Control.
D. Intox–8 (Chlordane).
E. Toxophene.

Replications: 6.

Sub-treatments:—

	S = 1 Single dose.	D = 2 Double dose.
A. H.E.T.P.	= 1 lb. in 100 gal.	2 lb. in 100 gal.

B.	Folidol E–605	= 1 lb. in 100 gal.	2 lb. in 100 gal.
C.	Intox–8	= ½ lb. in 100 gal.	1 lb. in 100 gal.
D.	Toxophene	= 3 lb. in 100 gal.	6 lb. in 100 gal.

The plan and layout is given below

12111	21212	11212	11122	21122	21121
CDEBA	BDEAC	BCAED	CEDBA	ADBEC	CADBE
21222	12121	22121	22211	12211	12212

Spacing of injections:—16 inches apart at every 16 inch point on each row.

Quantity of solution injected at each point is 18 to 20 c.c.

Quantity of solution per acre required is 120 gallons.

V. **Agronomy :**

20. *Study of basic yields for standardization of experimental plots.*

To find out the most suitable method of soil management in old coffee, replicated lay out on a latin square design has been set. Preliminary yield records were taken from individual plots in order to standardize them prior to carrying out the treatments. The yield of the plots are given below:—

Locality : Chethalli (Coorg). *Area of each plot :* Gross 16×10 plants.
Layout : 6 x 6 latin square. Nett 14×8 plants.
Variants : 6. *Shade :* Natural shade.
Variety : Arabica (Coorgs).
Age : About 20 yeaas.
Treatments: A = Trenching 1½ feet deep.
B = do ¾ feet deep.
C = Renovation pitting.
D = Light digging.
E = Heavy digging.
F = Control, only removing weeds.

TABLE L–VI: RRSULTS FROM CULTIVATION EXPERIMENT

Sl. No.	Treatments	YIELD PER ACRE							
		Ripe cherry in lb.				Calculated yield of clean coffee in cwt.			
		1950	1951	1952	1953	1950	1951	1952	1953
1	A	711	1362	193	2003	1·26	2·03	0·29	2·98
2	B	813	1040	145	2196	1·45	1·55	0·22	3·27
3	C	618	1004	126	2303	1·10	1·49	0·19	3·43
4	D	488	856	182	2003	0·87	1·27	0·27	2·98
5	E	588	810	150	1414	1·05	1·21	0·22	2·10
6	F	569	1395	167	1714	1·01	2·08	0·25	2·55
	Mean	631	1078	161	1939	1·12	1·61	0·24	2·89
	Critical Difference	465	754	68	904	—	1·12	0·10	1·35
	S.E.M.%	24·9	23·7	14·26	10·71				10·71
	Conclusion :								
		$\overline{\text{BACEFD}}$							
		$\overline{\text{FABCDE}}$							
		$\overline{\text{ADFEBC}}$							
		$\overline{\text{CBADFE}}$							

The plot to plot variation is high, and the data is being further scrutinized.

21. *Arabica Coffee-The influence of pruning on yields.*

The results of experiments started in 1946 are furnished below :—

Locality : Ghattedhulla (Coorg). *Layout :* Latin square 5 x 5.

Area of Experimental plot : 2·71 acres. *Shade :* Natural shade.

Variety : Arabica-Coorgs.

Variants : 5.

Area of each sub-plot : Nett 10 x 10 or 100 plants (1/12 acre)

Treatments : A – Light hot weather prune
B – Light monsoon prune
C – Medium hot weather prune
D – Medium monsoon prune
E – Control – no prune

TABLE L–VII : EFFECT OF PRUNING ON YIELDS

Treatments	1946	1947	1948	1950	1951	1952	1953
			Ripe cherry in lb. per acre.				
A	1346	2706	1754	1834	2267	643	2976
B	1224	2530	1782	1889	2520	866	2532
C	1020	3196	1686	1812	2253	780	2964
D	938	2652	2176	1915	2053	722	2832
E	1510	2708	2285	1509	2453	660	3240
General Mean :	1208	2758	1937	1759	2293	732	2904
Significant or not	Yes	No	No	No	No	No	No
Standard error	10·70	12·11	20·30	18·47	6·91	16·59	11·38
Critical difference	378	975	1164	932	733	374	1019
Conclusions :	EABCD	CAEBD	CBADE	DBCAE	BEACD	BCDEA	EACDB
			Calculated Clean Coffee in Cwt. per acre.				
A	2·00	4·03	2·61	2·73	3·37	0·96	4·43
B	1·82	3·76	2·65	2·81	3·75	1·29	3·77
C	1·52	4·76	2·51	2·70	3·35	1·16	4·41
D	1·30	3·95	3·24	2·85	3·06	1·07	4·21
E	2·25	4·03	3·40	2·25	3·65	0·98	4·82
General Mean :	1·80	4·10	2·88	2·62	3·41	1·09	4·32
Significant or not :	No	No	No	No	No	No	No
Standard error :	10·70	12·11	20·30	18·47	6·91	16·59	11·38
Critical difference :	0·52	1·45	1·73	1·39	1·09	0·56	1·52
Conclusions :						EACDB	

No difference among the treatments is noticeable.

22. *Robusta Pruning :* Another series of experiments was started in Coorg at (1) Yemmigoondi, (2) Pollibetta and (3) Cannoncadoo estates

for the study of the effects of pruning on Robusta. The following were the treatments tried—

A. Thinning out
B. Heading back
C. Control (no pruning)

Thinning out indicates removal of thin and weak branches and twigs which are less prone for cropping. This is done by the removal of those branches at their points of origin or at a place from where vigorous new shoots are expected to be formed. The object of thinning is to space the remaining branches and twigs to better advantage and to grow the plant generally to a desired shape and spread. The centering was done to a distance of 6 inches off the main stem.

Heading back: By this method, cropping of completely new wood instead of on extension growths of the current cropping branches is done. Just after the blossom, the terminal shoots are cut out beyond the last node with flowers. This stimulates new wood formation nearer the base of the cropping wood. When the crop is removed during the succeeding year, those parts of the branches which had borne the crop are cut off. The usual centering to 6 inches was also done.

The harvest in the different experimental plots indicates that the loss of crop does not exceed 15% of the control.

T. V. Pattabhiraman,
Senior Liaison Officer.

MISCELLANEOUS CROPS

Paddy was grown over an area of 6·0 acres at Chethalli and 1·67 acres at Balehonnur. Owing to very adverse seasonal conditions of inadequate rainfall during peak periods of watering and heavy precipitation during flowering and setting time, the yield of grain at both Stations was definitely low. The following quantities of grain and straw were obtained.

	Grain (Seers)	*Straw (lb.)*
Chethalli	2560·0	11200
Balehonnur	518·5	2280

The summer crop could be taken at either of these places.

Oranges : The crop at Chethalli where it is a major subsidiary crop, was very poor during the year. Blossom showers were most unfavourable and set was indifferent especially in the light of the heavy cropping in the previous year. The harvest of approximately 80,000 fruits was sold for Rs. 2,300 as against Rs. 6,830 in the previous year.

Specimen plots of green manure, fibre crops, cotton, Tung oil and new shade trees were raised at both Chethalli and Balehonnur for observational studies.

A small quantity of 25·25 lb. of pepper was picked at Balehonnur.

Farm Management :

Both the stations continued to be subscribing members of the U.P.A.S.I. and its labour department and of the regional Planters Associations.

Labour : Against a carry over of 130 on the labour check-roll at Balehonnur, the average daily turnout was as high as 125·08, showing a remarkably healthy state of labour-employer relationship. At Chethalli, the daily labour turnout was 84 against 96 on the check-roll.

Medical facilities : Medical facilities at both Stations were provided by part-time services of the local medical officers of the Mysore and Coorg administration. The anti-malarial squads of the local administrations attended to D.D.T. spraying of all estate quarters.

Harvest : Following are the harvest figures for coffee for the two Stations

	BALEHONNUR						CHETHALLI	
	Arabica		Robusta		Other Coffee		Arabica	Robusta
	Bshls	Srs.	Bshls	Srs.	Bshls	Srs.	Bshls	Bshls
A. Parchment	108	15	6	23			1071·0	—
B. Cherry	207	4	475	21	27	25	177·0	114·0
C. Gleanings & others	90	21	29	31			24·0	
	406	12	512	19	27	25	1272·0	114·0
Estimated yield of coffee during 1953–54.			16·5 tons,				18 tons.	

B. T. NARAYANAN,
Director of Research.

APPENDIX - I

RAINFALL DETA OF THE COFFEE RESEARCH STATION, BALEHONNUR (Mysore State)

(Rainfall recorded in inches)

Month	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	Average of 10 yrs.	1952-53
July	49·95	47·43	41·61	37·52	35·80	35·97	30·93	24·60	58·25	29·31	39·14	27·72
August	20·14	9·89	10·09	10·72	37·93	30·34	39·49	25·52	20·11	19·40	22·36	28·28
September	5·39	16·11	2·92	9·11	11·51	9·80	6·43	14·80	21·12	9·77	10·70	3·72
October	7·18	15·29	12·42	4·25	3·56	2·62	6·80	7·99	6·43	6·74	7·33	13·07
November	0·21	2·53	2·71	1·08	7·04	1·14	8·59	1·43	1·27	3·12	2·91	0·00
December	1·87	0·01	0·07	0·00	1·09	0·91	0·08	0·00	0·00	0·00	0·40	1·42
January	0·47	0·03	0·00	0·00	0·36	0·26	0·00	0·02	0·00	0·14	0·13	0·00
February	0·00	1·00	0·00	0·03	0·00	0·00	0·00	0·74	0·00	1·50	0·33	0·00
March	0·15	0·60	0·00	0·52	1·86	0·19	0·44	0·00	0·53	0·00	0·43	0·00
April	2·06	1·04	3·92	9·05	1·56	9·94	2·16	0·79	3·84	6·29	4·07	2·40
May	11·76	5·78	2·73	4·28	5·21	2·41	6·61	3·77	8·43	2·55	5·35	0·49
June	13·47	7·81	8·65	23·53	9·90	15·67	10·50	11·57	17·38	13·53	13·20	15·36
Total	112·65	107·52	85·12	100·09	115·82	109·25	112·03	91·23	137·86	92·35	106·35	92·46

APPENDIX I-A

METEOROLOGICAL DATA OF THE COFFEE RESEARCH STATION, BALEHONNUR — 1952-53

Sl. No.		July 1952	August 1952	Sep. 1952	October 1952	November 1952	December 1952	January 1953	February 1953	March 1953	April 1953	May 1953	June 1953
1	Highest maximum temperature – °F.	79·5	77·0	81·0	83·1	83·5	84·0	91·5	90·1	94·2	92·0	93·2	90·5
2	Lowest ,, ,, .	66·4	69·5	72·5	72·5	76·0	71·5	77·5	81·5	87·0	83·7	81·5	72·2
3	Highest minimum temperature – ,, .	67·5	66·4	66·4	68·0	62·0	65·6	64·4	64·0	69·0	69·0	71·0	69·4
4	Lowest ,, ,, .	64·0	63·0	58·0	55·0	54·5	57·4	54·0	55·7	61·4	62·4	62·3	63·0
5	Average maximum temperature – ,, .	73·1	72·0	78·3	77·5	79·9	78·1	82·3	86·7	90·0	87·8	87·6	82·4
6	Average minimum temperature – ,, .	65·7	65·2	66·3	63·8	56·6	60·9	58·3	60·1	64·9	66·1	66·0	66·8
7	Highest number of hours of bright sunshine.	7·12	7·00	10·30	10·54	10·54	10·30	11·00	10·42	10·42	11·00	11·30	11·06
8	Lowest ,, ,,	0·00	0·00	1·24	0·00	4·18	0·06	7·00	2·06	6·18	3·12	5·30	0·00
9	Average ,, ,,	1·37	2·05	6·58	4·42	9·37	7·41	9·48	0·08	9·00	8·16	9·08	5·02
10	No. of days on which rainfall was below 10 cents.	3	Nil	2	2	Nil	3	1	Nil	Nil	6	3	10
11	,, between 10–50 cents.	7	10	6	4	Nil	2	Nil	Nil	Nil	5	1	2
12	,, between 50–100 cents.	14	11	Nil	6	Nil	Nil	Nil	Nil	Nil	1	Nil	5
13	,, between 1–2 inches.	5	6	2	3	Nil	1	Nil	Nil	Nil	Nil	Nil	1
14	,, above 2 inches.	2	3	Nil	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	3
15	Total rainfall for the month.	27·72	28·28	3·72	13·07	Nil	1·42	0·02	Nil	Nil	2·40	0·49	15·36
16	No. of rainy days during the month.	28	30	8	14	Nil	3	Nil	Nil	Nil	6	1	11
17	Highest rainfall during the month.	7·46	3·87	1·35	2·07	Nil	1·01	0·02	Nil	Nil	0·61	0·41	4·51

APPENDIX-II

METEOROLOGICAL DATA OF THE COFFEE RESEARCH SUB-STATION, CHETHALLI (Coorg) 1952-53.

Month	Rainfall 1951-52	Average for previous 18 years	Rainfall 1952-53	Maximum Temperature oF 1951-52	Maximum Temperature oF 1952-53	Minimum Temperature oF 1951-53	Minimum Temperature oF 1952-53	Humidity % 1951-52	Humidity % 1952-53	Remarks
July	20·86	22·93	11·86	75·0	75·0	67·0	68·0	87·2	85·0	
August	6·33	11·89	10·60	77·2	74·0	68·0	68·0	84·8	90·5	
September	9·54	6·16	2·25	81·0	81·0	68·0	67·0	81·5	77·5	
October	6·38	6·61	8·25	80·0	78·0	68·0	68·0	82·0	82·0	
November	3·28	3·60	0·00	80·0	81·0	69·0	64·0	82·0	68·0	
December	0·00	0·57	2·11	78·0	81·0	61·0	64·0	74·8	77·3	
Januray	0·00	0·14	0·00	80·0	81·0	64·0	63·0	65·5	69·8	
February	0·09	0·25	0·00	84·7	83·0	66·6	64·0	69·3	62·0	
March	0·00	0·87	0·18	88·0	90·2	67·0	69·5	67·0	66·3	
April	4·37	3·98	2·14	89·0	87·0	71·0	71·0	74·0	75·2	
May	3·09	5·07	1·03	87·0	90·0	72·0	72·0	76·0	73·0	
June	8·36	11·15	12·17	78·0	86·0	69·0	71·0	81·0	80·0	
Total	62·30	73·22	50·59							

APPENDIX-III

ARABICA PULPING TRIALS USING PECTIC ENZYMES

Sl. No.	Time of observation	Temperature °F	pH	Time of observation	Temperature °F	pH	Time of observation	Temperature °F	pH	Time of observation	Temperature °F	pH	Time of observation	Temperature °F	pH
	Treatment A–1			**Treatment A–2**			**Treatment A–3**			**Treatment A–4**			**Treatment A–5**		
1	9·30 a.m.	68·9	6·2	9·35 a.m.	68·9	6·2	9·40 a.m.	68·9	6·2	9·45 a.m.	69·8	7·0	9·30 a.m.	68·9	6·5
2	11·30 a.m.	71·6	6·2	11·35 a.m.	71·6	6·2	11·40 a.m.	70·7	6·2	11·45 a.m.	69·8	5·9	11·30 a.m.	68·9	6·3
3	1·30 p.m.	71·6	5·8	1·35 p.m.	71·6	5·8	1·40 p.m.	71·6	5·4	1·45 p.m.	71·6	5·4	1·39 p.m.	68·9	6·3
4	3·30 p.m.	71·6	5·2	3·35 p.m.	71·6	5·2	3–40 p.m.	71·6	5·2	3·45 p.m.	72·5	5·2	3·30 p.m.	68·9	5·9
													5·30 p.m.	68·8	5·7
													7·30 p.m.	66·2	5·7
													7·30 a.m.	66·2	5·2
	Treatment B–1			**Treatment B–2**			**Treatment B–3**			**Treatment B–4**			**Treatment B–5**		
1	10·00 a.m.	68·9	6·2	10·05 a.m.	68·9	6·2	10·10 a.m.	68·9	6·2	10·15 a.m.	68·9	7·0	10·00 a.m.	68·0	6·5
2	12·00 noon.	69·8	6·2	12·05 p.m.	70·7	6·2	12·10 p.m.	70·6	6·2	12·15 p.m.	69·8	5·9	12·00 noon.	68·9	6·3
3	2·00 p.m.	72·5	5·6	2·05 p.m.	71·6	5·6	2·10 p.m.	71·6	5·4	2·15 p.m.	71·6	5·4	2·00 p.m.	68·9	6·3
4	4·00 p.m.	72·5	5·2	4·05 p.m.	72·5	5·2	4·10 p.m.	71·6	5·2	4·15 p.m.	73·4	5·2	4·00 p.m.	69·8	6·3
													6·00 p.m.	68·9	5·7
													8·00 p.m.	66·2	5·2
													8·00 a.m.	66·2	5·2

APPENDIX-IV

ROBUSTA PULPING TRIALS USING PECTIC ENZYMES

Quantity of raw parchment used – Four struck seers for each treatment – 4000 grams.

Sl. No.	Treatments	Date & Time	Temp. °C	pH	Date & Time	Temp. °C	pH	Date & Time	Temp. °C	pH	Date & Time	Temp. °C	pH	Date & Time	Temp. °C	pH
		1st Obsn.			2nd Obsn.			3rd Obsn.			4th Obsn.			5th Obsn.		
		5–1–53			5–1–53			5–1–53			6–1–53			6–1–53		
1	1/40% Benefax.	4·00 p.m.	22·95	6·3	6·00 p m.	23	5·9	8·00 p.m.	23·7	5·5	8·00 a.m.	23·5	4·6	10·00 a.m.	23·6	4·5
2	1/80% Benefax.	4·00 ,,	22·95	6·3	6·10 ,,	23	5·9	8·10 ,,	23·5	5·5	8·10 ,,	23·5	4·5	10·10 ,,	23·6	4·5
3	1/40% National chemical laboratories Pectinase.	4·20 ,,	22·95	6·4	6·20 ,,	22·95	5·9	8·20 ,,	23·2	5·5	8·20 ,,	23·4	4·5	10·20 ,,	23·5	4·5
4	1/80% ,	4·30 ,,	22·95	6·4	6·30 ,,	22·95	5·9	8·30 ,	23·0	5·5	8·30 ,,	22·8	4·5	10·30 ,,	23·0	4·5
5	Wood ashes @ 6 oz. per bushel.	4·40 ,,	22·95	9·5	6·40 ,,	22·95	8·5	8·40 ,,	23·0	7·8	8·40 ,,	23·2	6·5	10·40 ,,	23·5	6·5
6	Control.	4·00 ,,	22·95	6·3	6·00 ,,	22· 9	6·2	8·00 ,,	22·5	6·0	8·00 ,,	22·7	4·8	10·50 ,,	23·0	4·6
		6th obsn.			7th Obsn.			8th Obsn.			9th Obsn.			10th Obsn.		
		6–1–53			6–1–53											
1	1/40% Benefax.	12 noon	23· 6	4·2	2·00 p.m.	23· 6	4·2	Washed.			Washed.			Washed.		
2	1/80% Benefax.	12·10 p.m.	23· 6	4·4	2·10 ,,	23· 6	4·2	4·10 p.m.	23·6	4·2	6·10 p.m.	23·4	4·2	6·20 p.m.		
3	1/40% N. C. L. Pectinase.	12·20 ,,	23· 5	4·5	2·20 ,,	23· 5	4·2	4·20 ,,	23·6	4·2	Washed.			Washed.		
4	1/80% ,,	12·30 ,,	23· 2	4·5	2·30 ,,	23· 2	4·4	4·30 ,,	23·2	4·2	6·30 p.m.	23·2	4·2	Washed at 7·30 p.m.		
5	Wood ashes @ 6 oz/Bshl.	12·40 ,,	23· 5	6·5	2·40 ,,	23· 5	6·5	4·40 ,,	23·5	6·5	6·40 ,,	23·4	6·5	8·40 p.m.	23·2	6·3
6	Control.	12 noon	23· 2	4·6	2·00 ,,	23· 2	4·4	4·00 ,,	23·2	4·4	6·00 ,,	23·2	4·4	8·00 ,,	23·0	4·2

		11th Obsn.	12th Obsn.	Time of start	Time of washing	Total time of fermentation
1	1/40% Benefax.	6·1·53 Washed.	Washed.	5·1·53– 4 p.m.	6·1·53– 2 p.m.	22 hours.
2	1/80% Benefax.	Washed at 9·10 p.m.	Washed.	,, 4·10 p.m.	,, 9·10 p.m.	29 ,,
3	1/40% N. C. L. Pectinase.	Washed.	Washed.	,, 4·10 ,,	,, 6·20 ,,	26 hours–10 minutes.
4	1/80% ,,	Washed.	Washed.	,, 4·30 ,,	,, 7·30 ,,	27 hours.
5	Wood ashes@ 6 oz/Bushel.	Not ready for washing.	Not ready.	The mucilage got set to a hard jelly after about four hours after treatment & was sticking hard to the parchment surface. The washing was done at 5·50 p.m. on 7–1–53 and even then it was very difficult and clean wash was not possible.		
6	Control.	Not ready.	8 a.m. 23· 2 4·2	5·1·53– 4 p.m.	7·1·53– 8 a.m.	40 hours.

Weight of parchment taken was 4000 grams in each case. For treatment No. 1, 1·0 gram of Benefax, for Treatment No. 2, 0·5 gram of Benefax, for Treatment 3, 1·0 gram of N. C. L. Pectinase, for Treatment No. 40·5 gram of N. C. L. Pectinase and for treatment No. 5, 24·3 grams of wood ashes were applied respectively.

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